TECNOLOGIA SETÚBAL
ESCOLA SUPERIOR POLITÉCNICO SETÚBAL

PEDRO MARIA ALVES DE JESUS

AVALIAÇÃO DE MEDIDAS DE EFICIÊNCIA ENERGÉTICA NUM EDIFÍCIO INDUSTRIAL

Relatório de Projecto em Engenharia e Gestão de Energia do Mestrado em Engenharia e Gestão de Energia na Indústria e Edifícios

ORIENTADOR
Doutor Paulo Miguel Marques Fontes

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PEDRO MARIA
ALVES DE JESUS

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JÚRI

Presidente: Doutor Luís Manuel Rodrigues Coelho, ESTSetúbal/IPS
Orientador: Doutor Paulo Miguel Marques Fontes, ESTSetúbal/IPS
Arguente: Doutor João Francisco dos Santos Fernandes, ESTSetúbal/IPS

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Resumo

O objectivo deste trabalho é contribuir para melhorar o desempenho energético de um edifício inserido num complexo industrial, na zona do Médio Oriente, e reduzir o seu consumo eléctrico e as suas emissões de CO_2. O estudo partiu do projecto original que foi efectuado com base em sistemas tradicionalmente usados na indústria local que, por ainda usarem aquecimento eléctrico, não são os mais ajustados às exigências actuais de eficiência energética e emissões de CO_2. Tendo em conta a tendência actual de crescimento dos consumos na região, sobretudo no sector industrial, estas práticas já não são sustentáveis. Torna-se fundamental uma evolução nas práticas usadas na construção e na concepção dos sistemas de AVAC. Neste estudo propõem-se quatro alternativas de melhoria que podem ser implementadas no edifício, tendo como foco duas áreas de actuação: a envolvente do edifício (isolamento) e o tipo de sistemas de AVAC (*Chiller* e Bomba de Calor, *Chiller* com recuperação e Humidificador adiabático). Para testar estas hipóteses, usou-se o *software* de cálculo HAP 6.2 para criar modelos do edifício e dos sistemas de AVAC que permitiram calcular os seus consumos e emissões. Da análise dos resultados obtidos, verificou-se uma redução anual no consumo de energia e emissões de CO_2 do edifício para todas as hipóteses estudadas, excepto para a alternativa do *Chiller* com recuperação. Obtiveram-se as seguintes reduções: 7,4% para a alternativa da envolvente, 33,1% para a hipótese do *Chiller* e Bomba de calor e 20,9% no caso do Humidificador Adiabático. Concluiu-se que com melhorias na envolvente do edifício e com a optimização e melhoria da eficiência dos sistemas de AVAC, é possível equilibrar o crescimento das necessidades dos sistemas e satisfazer as mesmas necessidades com um menor consumo de energia. Em paralelo, também se registou uma redução nos custos do consumo de energia dos sistemas de AVAC. Obtiveram-se as seguintes reduções: 9,7% para a alternativa da envolvente, 42,3% para a hipótese do *Chiller* e Bomba de Calor e 33,0% no caso do Humidificador Adiabático. Em suma, usar as alternativas aqui propostas, além de contribuir para resolver o rápido aumento do consumo de electricidade e emissões de CO_2, em particular no que diz respeito aos sistemas de AVAC, tem também um impacto na economia da região.

Palavras-chave: Aquecimento eléctrico, AVAC, Edifício Industrial, Eficiência energética, Emissões de CO_2, Médio Oriente.

Abstract

The objective of this work is to contribute to improving the energy performance of a building located within an industrial complex in the Middle East region, and to reduce its electricity consumption and CO_2 emissions. The study began with the original project which was carried out based on systems traditionally used in the local industry. As these still use electric heating, they are not the most suitable for current energy efficiency and CO_2 emission requirements. Given the current trend of increasing consumption in the region, especially in the industrial sector, these practices are no longer sustainable. An evolution in the practices used in construction and in the design of HVAC systems is essential. In this study, four improvement alternatives that can be implemented in the building are proposed, focusing on two areas of action: the building envelope (insulation) and the type of HVAC systems (Chiller and Heat Pump, Chiller with recovery and Adiabatic Humidifier). To test these hypotheses, the HAP 6.2 calculation software was used to create models of the building and the HVAC systems, which allowed for the calculation of their consumption and emissions. Analysis of the results obtained showed an annual reduction in energy consumption and CO_2 emissions of the building for all hypotheses studied, except for the Chiller with recovery alternative. The following reductions were obtained: 7.4% for the envelope alternative, 33.1% for the Chiller and Heat Pump hypothesis and 20.9% in the case of the Adiabatic Humidifier. It was concluded that with improvements to the building envelope and with the optimisation and improvement of the efficiency of the HVAC systems, it is possible to balance the growth in system needs and satisfy those same needs with lower energy consumption. In parallel, a reduction in the energy consumption costs of the HVAC systems was also recorded. The following reductions were obtained: 9.7% for the envelope alternative, 42.3% for the Chiller and Heat Pump hypothesis and 33.0% in the case of the Adiabatic Humidifier. In summary, using the alternatives proposed here, in addition to helping to resolve the rapid increase in electricity consumption and CO_2 emissions, particularly with regard to HVAC systems, also has an impact on the region's economy.

Keywords: Electric heating, HVAC, Industrial Building, Energy efficiency, CO_2 emissions, Middle East.

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Lista de Siglas e Acrónimos

APS	*Announced Pledges Scenario*
AVAC / HVAC	Aquecimento Ventilação e Ar Condicionado / *Heating Ventilation and Air Conditioning*
BC	Bomba de Calor
CAV	*Constant Air Volume damper*
CH	*Chiller*
FCU	*Fan Coil Unit*
MEPS	*Minimum Energy Performance Standards*.
PFD	*Process Flow Diagrams*
REC	Recuperação de Calor
UPS	*Uninterruptible power supply*
UTA / AHU	Unidade de Tratamento de Ar / *Air Handling Unit*
UTAN / FAHU	Unidade de Tratamento de Ar Novo / *Fresh Air Handling Unit*
VAV	*Variable Air Volume damper*

Capítulo 1
Introdução

Neste capítulo expõem-se a motivação que conduziu à realização deste projecto, apresenta-se o respectivo enquadramento e efectua-se um pequeno resumo de cada um dos capítulos com referência às contribuições mais relevantes.

1.1 Enquadramento geográfico e energético

De acordo com o relatório "*The Future of Electricity in the Middle East and North Africa*" [1], o clima do Médio Oriente é caracterizado por calor extremo e escassez de água. As temperaturas médias estão a aumentar ao dobro da velocidade do resto do mundo e as temperaturas no Verão ultrapassam com frequência os 40 °C. Hoje o arrefecimento é responsável por cerca de metade dos picos de consumo eléctrico e um quarto do consumo total anual de electricidade. A produção de electricidade é feita quase exclusivamente à custa de combustíveis fósseis, sendo que o gás natural e o petróleo representam 90% da geração de energia eléctrica na região.

A indústria continua a ser o sector com maior consumo de energia, tendo triplicado devido ao contínuo crescimento do sector industrial. Em 2023, os edifícios foram responsáveis por 66% do consumo de electricidade, seguidos pela indústria com 24%. Desde 2000 a procura por equipamentos de ar condicionado triplicou. No entanto, a eficiência dos equipamentos não está ao nível dos requisitos dos *Minimum Energy Performance Standards* (MEPS) do país [1].

Como consequência do rápido aumento do consumo de electricidade também se verifica um aumento significativo das emissões. Entre 1990 e 2023, as emissões de CO_2 por unidade de PIB aumentaram 11% na região o que contrasta com uma diminuição da média global em 37%, no mesmo período [1].

É esperado que, até 2035, o arrefecimento seja o maior responsável pelo aumento do consumo de electricidade no Médio Oriente. Estima-se que o arrefecimento e a dessalinização sejam responsáveis por um aumento de 40% do consumo na região; este crescimento é muito superior à média global [1].

A eficiência energética é crucial para a gestão do aumento dos consumos eléctricos, especialmente no que diz respeito aos edifícios visto que a eficiência dos ar condicionados na região é menos de metade da dos equipamentos usados, por exemplo, no Japão. Estima-se que melhorar a eficiência dos ar condicionados poderá reduzir o aumento dos picos de consumo eléctrico em 35 GW até 2035 [1].

Espera-se que a melhoria na eficiência dos equipamentos, combinada com um melhor isolamento dos edifícios, ajude a equilibrar o crescimento das necessidades de arrefecimento, tornando possível satisfazer as mesmas necessidades de arrefecimento com um menor consumo de electricidade [1].

1.2 Objectivos do projecto

Neste contexto, o presente projecto tem como objectivo identificar e avaliar medidas de melhoria que possam ser implementadas no edifício em estudo, tendo como foco duas áreas de actuação: a envolvente do edifício e o tipo de sistemas de Aquecimento Ventilação e Ar Condicionado (AVAC).

O edifício em estudo é um Edifício de Controlo de uma unidade industrial, com uma área total de pavimento de 2 620 m², distribuída por três pisos e com duas tipologias principais: escritórios e áreas técnicas. O edifício é constituído por: sala de controlo, gabinetes, salas de reuniões, circulações, instalações sanitárias, arrumos, zonas de refeições, salas de oração, salas eléctricas, UPS, baterias, comunicações, servidores e salas de AVAC. O edifício está localizado num país do Médio Oriente. Por motivos de confidencialidade, a localização exacta não pode ser divulgada por se tratar de um edifício real em que o cliente prefere ficar anónimo. As coordenadas reais e orientação do edifício foram usadas no programa de calculo HAP 6.2.

O projecto original foi efectuado com base nos requisitos do cliente, sendo que a envolvente do edifício foi originalmente definida com base nos standards da especialidade de civil e o tipo de sistemas de AVAC projectados foram baseados em sistemas tipo do cliente, usados anteriormente em outros edifícios.

A envolvente original do edifício é do tipo parede dupla com caixa de ar e sem qualquer tipo de isolamento, quer nas paredes quer nos pilares e vigas. Apenas a cobertura apresenta algum isolamento. Considerando a localização geográfica do edifício (Médio Oriente), o tipo de clima (temperaturas de projecto de Verão de 51,7 °C) e a experiência em projectos similares com as mesmas características na mesma zona geográfica, em que os standards são mais exigentes do que os requisitos mínimos do cliente, este tipo de envolvente não parece proporcionar o isolamento adequado do edifício.

O sistema de climatização do edifício foi dividido em 5 sistemas independentes que correspondem às várias tipologias dos espaços. Todos os sistemas foram projectados de acordo com os requisitos do cliente e são compostos por UTA/AHU arrefecidas por unidades condensadoras remotas. A unidade típica é constituída por: caixa de mistura, filtros, baterias de frio de expansão directa redundantes, silenciadores, ventilador, humidificador e bateria de aquecimento eléctrica.

As UTA/AHU são responsáveis pelo fornecimento de ar novo para ventilação e pressurização do edifício, bem como pelo tratamento das cargas térmicas do ar novo e dos espaços. Dependendo das necessidades dos espaços, o caudal de insuflação pode ser constante ou variável e, consoante o tipo de espaço, poderão também existir baterias eléctricas de aquecimento/reaquecimento para controlo individual da temperatura. Existem ainda unidades do tipo *Split* nas salas eléctricas que necessitem de arrefecimento redundante.

Cada central de AVAC está equipada com um conjunto de admissão de ar novo composto por filtro de areia, conjunto de filtros e ventiladores redundantes. Existe ainda um par de ventiladores redundantes de extracção, Figura 1-1.

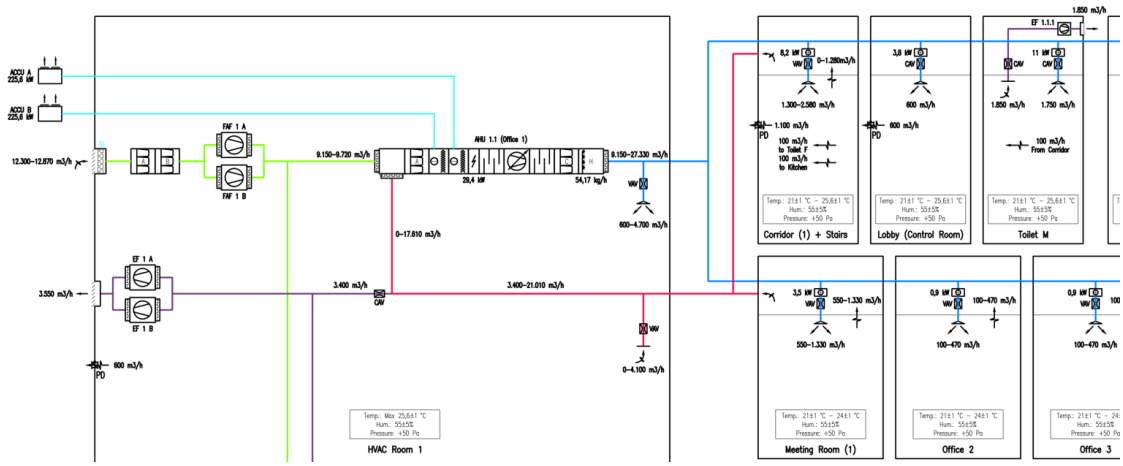

Figura 1-1 – Sistema de climatização - Original

Este sistema apresenta duas grandes desvantagens do ponto de vista da eficiência energética:

1 As Unidades de Tratamento de Ar (UTA/AHU) usam baterias eléctricas para o aquecimento/reaquecimento
2 O arrefecimento do ar dos espaços é feito pelas UTA/AHU, o que requer o uso adicional de baterias eléctricas, em cada espaço, para reaquecimento do ar de insuflação, de modo que seja possível o controlo individual da temperatura.

Com este projecto, pretendeu-se, portanto, avaliar alternativas para a envolvente do edifício e os seus sistemas de AVAC, com vista a melhorar o desempenho energético do edifício, reduzir o consumo eléctrico e as emissões de CO_2.

1.3 Hipóteses do projecto

O uso de arrefecimento adiabático foi inicialmente considerado para este projecto como uma alternativa interessante, tendo em conta o clima em que o edifício está localizado. No entanto, devido á escassez de água na região, esta hipótese foi descartada visto que esta solução implica um aumento de consumo de água, tornando-a pouco viável.

1.3.1 Alternativa da envolvente

Nesta alternativa pretendeu-se testar a hipótese de que, seguindo os requisitos do regulamento do país [2], no que respeita aos valores mínimos de transmissão térmica U, seria possível reduzir significativamente os consumos eléctricos e as emissões de CO_2 do edifício.

Com base nesses novos requisitos do regulamento, considerou-se modificar os elementos da envolvente do edifício para que cumprissem os novos valores mínimos de U, de modo a comparar os consumos eléctricos e as emissões de CO_2.

1.3.2 Alternativas dos sistemas de AVAC

1.3.2.1 Chiller e Bomba de Calor

Nesta alternativa pretendeu-se testar a hipótese de que, recorrendo a sistemas que não usam aquecimento eléctrico, em que as Unidades de Tratamento de Ar Novo (UTAN/FAHU) apenas

tratam o ar novo e o tratamento do ar dos espaços é feito nos próprios espaços, seria possível reduzir significativamente os consumos eléctricos e as emissões de CO_2 do edifício.

Considerou-se modificar os sistemas, da seguinte forma, Figura 1-2:

1. Em vez de aquecimento eléctrico, todos os sistemas passariam a ser compostos por UTAN/FAHU com recuperação de calor, a água para arrefecimento seria produzida por um *Chiller* do tipo Ar-Água e a água para o aquecimento seria produzida por uma Bomba de Calor do tipo Ar-Água.
2. Relativamente ao tratamento do ar novo, as UTAN/FAHU passariam a ser apenas responsáveis pelo fornecimento e tratamento das cargas térmicas e caudal de insuflação passaria a ser constante.
3. Relativamente ao tratamento do ar dos espaços, este passaria a ser feito por unidades locais do tipo ventilo convector a 4 ou 2 tubos.

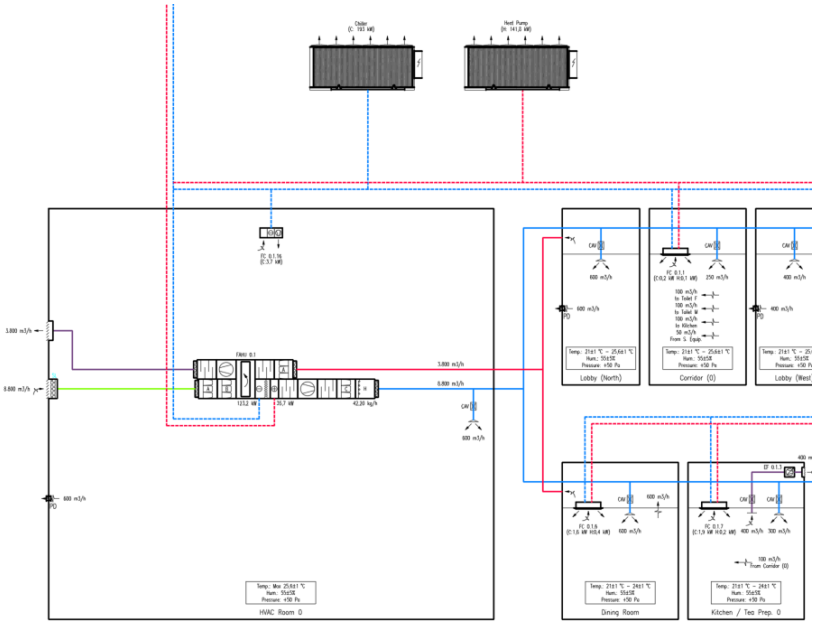

Figura 1-2 - Sistema de climatização – Alt. *Chiller* e Bomba de Calor

1.3.2.2 Chiller com recuperação

Nesta variante pretendeu-se ir mais além ao testar o uso de um *Chiller* com recuperação de calor, em vez de um *Chiller* e de uma Bomba de calor em separado. O objectivo seria usar o calor retirado das salas técnicas, durante o Inverno, para aquecer o ar novo e os espaços que necessitem de aquecimento. Confirmando-se esta hipótese, seria possível reduzir ainda mais os consumos eléctricos e as emissões de CO_2 do edifício.

1.3.2.3 Humidificador adiabático

Nesta variante pretendeu-se ir ainda mais além ao substituir o humidificador tradicional, em que a água para humidificação é evaporada numa caldeira eléctrica, por um humidificador adiabático, em que a água é pulverizada e em que o único consumo eléctrico é o da bomba do humidificador. Confirmando-se esta hipótese, seria possível reduzir ainda mais os consumos eléctricos e as emissões de CO_2 do edifício.

1.4 Estrutura do Relatório

O presente Relatório encontra-se dividido em 4 capítulos:

O primeiro capítulo expõe a motivação que conduziu à realização deste projecto, apresenta o respectivo enquadramento e efectua um pequeno resumo de cada um dos capítulos.

No segundo capítulo são apresentados os métodos usados neste projecto para testar as hipóteses que foram propostas. São ainda apresentados de forma sucinta o projecto original e toda a informação associada, tais como os standards do cliente e do país, que serviram de base para este projecto e para estudar as suas alternativas.

No terceiro capítulo são apresentados e analisados os resultados das quatro hipóteses que foram testadas neste projecto.

Por fim no quarto capítulo são apresentados de forma resumida os resultados e as conclusões deste projecto e a sua contribuição para resolver as questões referidas na introdução. São ainda apresenta recomendações para investigação futura e formas de dar continuidade a este projecto.

Capítulo 2
Método

Neste capítulo são apresentados os métodos usados neste projecto para testar as hipóteses que foram propostas. São ainda apresentados de forma sucinta o projecto original e toda a informação associada, tais como os standards do cliente e do país, que serviram de base para este projecto e para estudar as suas alternativas.

2.1 Introdução

O edifício de controlo usado neste estudo faz parte de um projecto real de um complexo industrial num país do médio oriente com vários edifícios e zonas de produção. O projecto de AVAC foi feito com base nas plantas de arquitectura (Anexo III), os standards do cliente [3] [4] [5] [6] [7] [8] [9] que são baseados nos standards do país [2] [10]. Começou-se por compilar a informação relevante dos standards no documento *Design Criteria* (Anexo II) que serviu de base para a execução do projecto. De seguida foi criada uma *Room Criteria List* (Anexo V) onde foram listados todos os espaços e os seus respectivos requisitos. Por fim foram definidos os sistemas de AVAC que se pretendeu usar e que foram esquematizados nos *Process Flow Diagrams* (Anexo VI). Esta informação foi a base para a configuração do *software* de cálculo HAP 6.2 usado para criar os modelos do edifício e dos sistemas de AVAC que permitiram calcular os seus consumos e emissões.

2.2 *Design Criteria*

O objectivo deste documento, Anexo II, foi definir os requisitos mínimos do projecto de AVAC, bem como as orientações gerais para o projecto dos sistemas de AVAC. Os sistemas AVAC devem proporcionar um ambiente de trabalho interior seguro através de ventilação, ar condicionado, filtragem do ar e pressurização do espaço, mantendo assim o conforto térmico necessário e uma qualidade do ar aceitável.

Neste documento descreveram-se os critérios a ser utilizados para o projecto, cálculos, dimensionamento, selecção dos equipamentos, controlo, testes, operação e manutenção dos sistemas AVAC.

Em caso de inconsistência, conflito ou discrepância dentro de qualquer um dos Códigos, Normas, Especificações e requisitos estatutários aplicáveis, prevalece o requisito mais rigoroso e seguro aplicável ao projecto.

2.3 *Room Criteria List*

Numa primeira fase, o objectivo deste documento, Anexo V, foi listar todos os espaços do edifício e seus respectivos requisitos, nomeadamente: áreas, volumes, tipos de actividade, horários, temperaturas e humidades interiores e exteriores, pressurização, caudais mínimos de ar novo por área e por pessoa. No documento, e com base nesta informação, foram ainda calculados os caudais mínimos de ar novo por espaço. Estes dados serviram para a configuração do *software* de cálculo.

Numa segunda fase, e após efectuados os cálculos de cargas dos espaços no *software*, registaram-se os resultados obtidos.

2.4 *Process Flow Diagrams* (PFD)

Nestes desenhos, Anexo VI, esquematizaram-se os vários espaços com os seus requisitos: de temperatura, de humidade, de pressurização, bem como os vários sistemas de AVAC que os servem e os respectivos caudais.

Relativamente aos sistemas, são apresentadas as várias unidades de ventilação UTA/AHU com os seus componentes e também ventiladores, unidades S*plit*, filtros, entre outros.

2.5 Modelação do edifício e sistemas

Usou-se o *software* de cálculo HAP 6.2 para criar modelos do edifício e dos sistemas de AVAC que permitiram calcular os seus consumos e emissões.

Para descrição detalhada da configuração do *software* de cálculo HAP 6.2 ver Relatório Cálculos HAP, Anexo I.

2.5.1 Weather Properties

2.5.1.1 Localização

O edifício está localizado num país do médio oriente. A localização exacta não pode ser divulgada por se tratar de um edifício real em que o cliente prefere ficar anónimo. As coordenadas reais e orientação do edifício foram usadas no programa de cálculo HAP.

2.5.1.2 Dados climáticos

Utilizou-se a função de *Wizard* do programa para seleccionar os dados climáticos para a localização do edifício:

- Local: País do médio oriente
- Altitude: 132 m

2.5.1.3 Temperaturas

As temperaturas exteriores de projecto foram obtidas dos standards do cliente [11]. Esta informação foi introduzida no menu *Weather Properties* do programa.

- Temperaturas de Inverno
  - Temperatura de bolbo seco: 4,5 °C
  - Temperatura de bolbo húmido: 2,0 °C
  - Humidade relativa: 64,6%
- Temperaturas de Verão
  - Temperatura de bolbo seco: 51,7 °C
  - Temperatura de bolbo húmido: 28,9 °C
  - Humidade relativa: 18,7%

No menu *Weather Properties* do programa definiram-se também a zona horária, o dia de semana do primeiro dia do ano, os feriados aplicáveis ao local e os períodos de hora de Verão e Inverno. No local do edifício não é observada a hora de Verão.

É importante referir que se trata de um edifício de apoio às operações da unidade industrial que opera 24 horas por dia, 365 dias por ano. Nos perfis de utilização não foi feita distinção entre dias de semana, fins de semana e feriados.

Para os restantes parâmetros optou-se por utilizar os valores por defeito do programa para o local.

2.5.2 Building Properties

Com base nas plantas, cortes e alçados do edifício construiu-se no HAP o modelo do edifício no separador *Building Properties.* É possível ver o edifício em 3D, Figura 2-1 e Figura 2-2

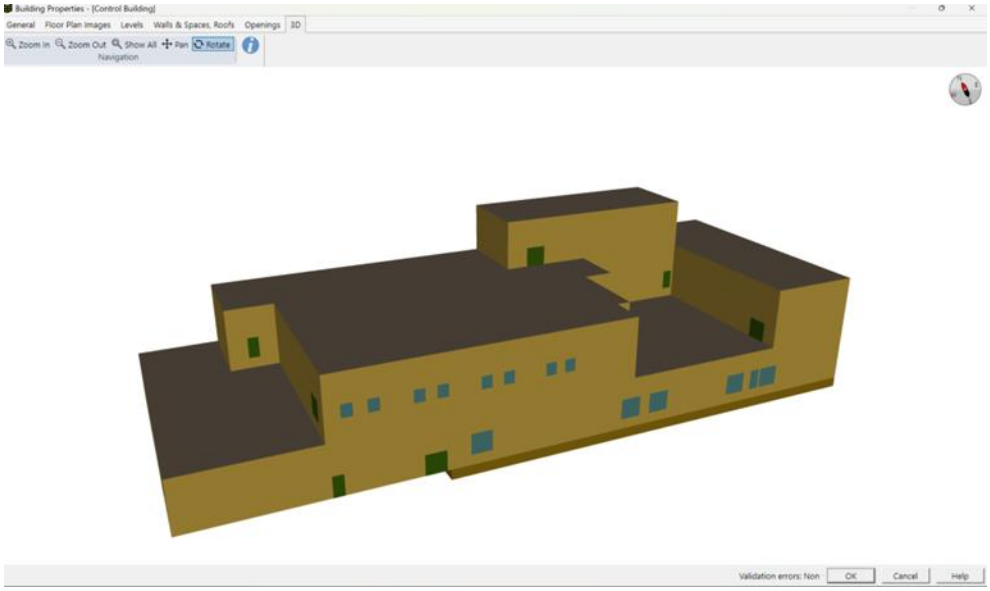

Figura 2-1 - *HAP Building Properties – 3D View 1*

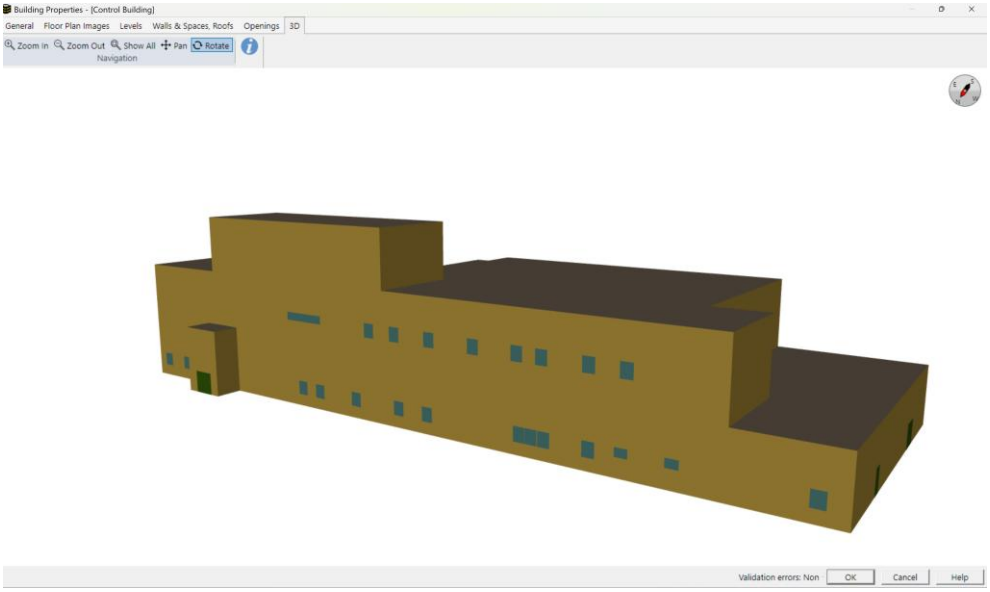

Figura 2-2 - *HAP Building Properties – 3D View 2*

2.5.3 Definição da Envolvente

Inicialmente para os valores do coeficiente de transmissão térmica (U) usou-se como referência os desenhos de arquitectura, Figura 2-3, e os requisitos do cliente. Segundo estes: os componentes da envolvente do edifício (Paredes Exteriores, Telhados e Pavimentos) dos espaços não climatizados ligados a espaços climatizados devem ter valores U semelhantes aos espaços climatizados; os pavimentos com ligação ao exterior devem ter valores U semelhantes aos dos telhados e as divisórias expostas a áreas não climatizadas devem ter valores U semelhantes aos das paredes exteriores.

LEGEND - WALL TYPE

TAG	SYMBOL	DESCRIPTION
P1		100 mm THK (MIN) EXTERNAL WALL + 50 mm GAP + 100 mm THK INSIDE WALL 20 THK INSIDE / EXTERNAL PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY
P2		200 THK INTERNAL CMU WALL (CONCRETE MASONRY UNIT) (20 THK INSIDE PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY)

Figura 2-3 – Legenda das paredes nos desenhos de Civil

Com base nos desenhos de arquitectura construíram-se os elementos da envolvente que podem ser consultados no documento *Building Envelope Calculations* (Anexo IV).

Estes dados foram usados na biblioteca de *Assemblies* do HAP. Não sendo possível no programa diferenciar entre paredes, pilares e vigas optou-se por usar um valor médio ponderado para a envolvente exterior.

Nesta fase do projecto não existia informação detalhada sobre as Janelas e Portas, tendo sido usados os valores mínimos de referência definidos no regulamento local [2].

A envolvente considerada tem os seguintes valores de U:

- Paredes Exterior Média: 1,462 W/m²·K
  - Parede: 1,330 W/m²·K
  - Pilares/Vigas: 1,946 W/m²·K
- Parede Exterior Enterrada: 1,435 W/m²·K
- Parede Interior: 1,442 W/m²·K
- Cobertura: 0,571 W/m²·K
- Pavimentos Contacto Solo: 0,592 W/m²·K
- Pavimentos Interior: 1,742 W/m²·K
- Janelas (1):
  - Transmissão: 3,61 W/m²·K
  - Factor solar: 40%
- Portas: 2,0 W/m²·K

(1) Proporção entre janelas e parede <10%

2.5.4 Space Models

Cada espaço ou conjunto de espaços foram associados a zonas que são controladas pelo mesmo termóstato e partilham o mesmo equipamento terminal.

2.5.4.1 Spaces

Na janela *Spaces* do HAP introduziram-se os dados para as divisões com necessidades de climatização, como descrito no documento *Design Criteria* (Anexo II). Toda esta informação está compilada no documento *Room Criteria List* (Anexo V).

2.5.4.2 Ventilação

A ventilação funciona 24 horas por dia 7 dias por semana, de modo a manter o edifício com uma sobrepressão de 50 Pa e todas as divisões ventiladas com os caudais mínimos indicados nos standards.

2.5.4.3 Iluminação

Nesta fase do projecto não existia informação detalhada sobre a iluminação, tendo sido assumido que a iluminação é do tipo led com um valor de 5 W/m². A iluminação funciona 24 horas por dia 7 dias por semana.

2.5.4.4 Equipamento eléctrico

A potência dissipada pelos equipamentos foi estimada para os escritórios e fornecida pela especialidade de electricidade e instrumentação para as salas eléctricas. Os escritórios e as salas eléctricas funcionam 24 horas por dia 7 dias por semana.

2.5.4.5 Ocupação

A ocupação dos espaços foi fornecida pela especialidade de arquitectura de acordo com as especificações do cliente. Os escritórios funcionam 24 horas por dia 7 dias por semana.

2.5.4.6 *Infiltração*

Como o edifício é pressurizado a 50 Pa, não foi considerada infiltração.

2.5.5 *Sistemas de Climatização*

O sistema de climatização do edifício está dividido em 5 sistemas independentes:

- AHU 0.1 - Escritórios do R/C
- AHU 0.2 - Salas de telecomunicações
- AHU 0.3 - Sala de baterias
- AHU 1.1 - Escritórios do 1° andar
- AHU 1.2 - Salas técnicas

Todos os sistemas foram projectados de acordo com os requisitos do cliente e são compostos por UTA/AHU arrefecidas por unidades condensadoras remotas. A unidade típica é constituída por caixa de mistura, filtro do tipo A, baterias de frio de expansão directa redundantes, bateria de aquecimento eléctrica, silenciador, ventilador, silenciador, filtro tipo C e humidificador.

As UTA/AHU são responsáveis pelo fornecimento de ar novo para ventilação e pressurização, bem como pelo tratamento das cargas térmicas do ar novo e dos espaços. Dependendo das necessidades dos espaços, o caudal de insuflação pode ser constante ou variável.

Dependendo do tipo de sala poderão ainda existir os seguintes sistemas adicionais:

- Ventiladores de extracção locais - Casas de banho e cozinhas
- Baterias eléctricas de aquecimento/reaquecimento – Todas as salas
- Par de ventiladores de extracção ATEX na sala de baterias.
- Unidades tipo *Split* nas salas eléctricas que necessitem de arrefecimento redundante.

Cada central de AVAC está equipada com um conjunto de admissão de ar novo composto por filtro de areia, conjunto de filtros tipo A e B e conjunto de ventiladores redundantes. Existe ainda um par de ventiladores redundantes de extracção, Figura 2-4.

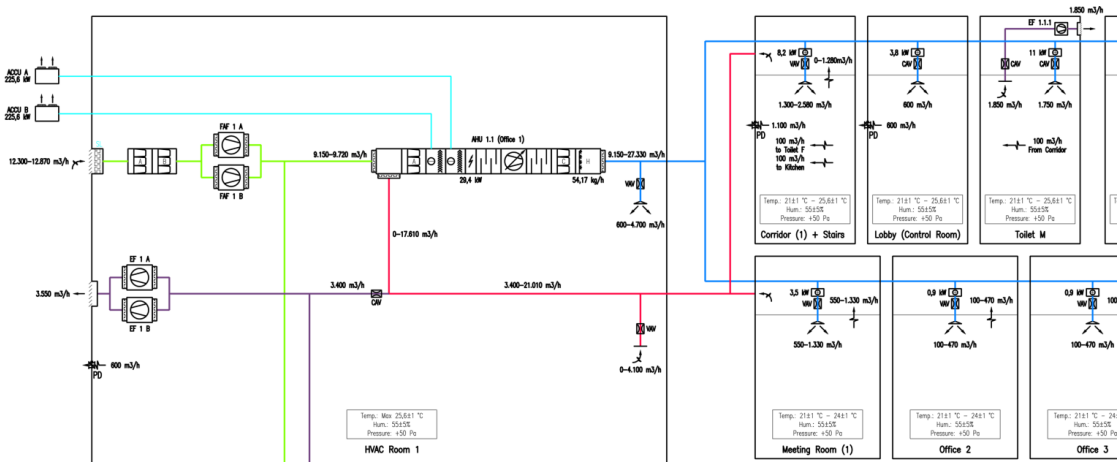

Figura 2-4 – Sistema de climatização tipo - Original

2.5.5.1 *Air System Properties*

Foram seleccionados e configurados os vários elementos das UTA/AHU, zonas tratadas pelas UTA/AHU, os termóstatos e as unidades terminais (baterias de reaquecimento e VAV's).

Foram ainda definidos os factores de segurança, as temperaturas de funcionamento das unidades condensadoras e o seu coeficiente de performance. Nesta fase do projecto ainda não tinham sido seleccionadas as unidades finais, tendo sido usados valores retirados de catálogos de equipamentos usados em projectos semelhantes do cliente.

2.5.6 Alternatives

No *software* HAP, uma *Alternative* permite, para um cenário de projecto que está a ser estudado, combinar os vários sistemas, centrais, *Space models* e edifícios.

2.5.6.1 Misc. Energy

No separador *Misc. Energy* consideraram-se todos os equipamentos que consomem energia, mas que ainda não foram considerados nos *Systems*. Estes equipamentos têm consumo de energia, mas não contribuem para as cargas internas dos espaços. Neste caso consideraram-se os ventiladores de extracção dos espaços e os ventiladores de ar novo e extracção das centrais de AVAC.

Por fim foi criado um perfil de utilização para os ventiladores, em que o ventilador funciona a 100% 24 horas por dia 7 dias por semana todos os dias do ano.

2.5.6.2 Meters

No separador *Electric Rates* criou-se um perfil novo para as tarifas eléctricas. A tarifa de energia para consumidores não residenciais no local do edifício é de 0,072 €/kWh (valor retirado de fonte da internet para o local do edifício em estudo que não pode ser identificado).

Relativamente ao valor das emissões de CO_2 por kWh, não tendo tido acesso a valores para o local do projecto e para ser possível efectuar comparações, utilizou-se o valor da tabela 107 do manual SCE [12], cujo factor de conversão de energia primária para emissões de CO_2 no caso da electricidade é de 0,144 $kgCO_2/kWh_{EP}$. Foi necessário ainda converter a energia final para energia primária. O factor de conversão é indicado na tabela 106 do manual SCE [12] e tem o valor de 2,5 kWh_{EP}/kWh. Feita a conversão obteve-se um valor de 0,36 $kgCO_2/kWh$.

No separador *Meters* seleccionou-se a tarifa eléctrica criada no menu *Electric Rates*. Sendo necessário ainda introduzir o factor de conversão de energia final para energia primária que se considerou ser de 2,5 kWh_{EP}/kWh, o que corresponde a uma eficiência de 40%.

2.5.7 Cálculo de Cargas

Para cada sistema do edifício foram feitos os cálculos de cargas após o que se obteve os vários relatórios com as cargas térmicas dos espaços, as potências e caudais das UTA/AHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi compilada no documento *Room Criteria List* (Anexo V) que permitiu dimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o PFD-Civil (Anexo VI).

2.5.8 Simulações

Nesta fase todos os dados relativos ao edifício e seus sistemas foram introduzidos no HAP. O cálculo de energia pode ser feito a vários níveis: do edifício, da central ou dos sistemas. No caso dos sistemas usados neste projecto só existem resultados no nível Edifício uma vez que não existem sistemas centralizados. Os resultados da simulação serão apresentados no capítulo 3.

2.6 Modelação da alternativa da envolvente

Relativamente ao modelo original, nesta alternativa apenas se alteraram os valores de transmissão térmica U, usando-se como referência o regulamento do país [2].

A nova envolvente considerada tem de cumprir com os seguintes valores de U:

- Paredes Exteriores: 0,568 W/m²·K
  - Pilares: 0,568 W/m²·K
  - Vigas: 0,398 W/m²·K
- Cobertura: 0,398 W/m²·K
- Pavimentos: 0,568 W/m²·K
- Janelas (1):
  - Transmissão: 3,61 W/m²·K
  - Factor solar: 40%
- Portas: 2,0 W/m²·K

(1) Proporção entre janelas e parede <10%

Com base nos desenhos de arquitectura construíram-se os novos elementos da envolvente que podem ser consultados no documento *Building Envelope Calculations* (Anexo IV). Não sendo possível no programa diferenciar entre paredes, pilares e vigas optou-se por usar um valor médio ponderado para as paredes exteriores. Como neste caso os valores são muito próximos optou-se por usar um valor de U do pior caso, ou seja, da parede exterior enterrada. Nesta fase do projecto não existia informação detalhada sobre as Janelas e Portas, tendo sido usados os valores mínimos de referência definidos no regulamento do país [2].

2.6.1 Cálculo de Cargas

Para cada sistema do edifício foram novamente feitos os cálculos de cargas após o que se obteve os vários relatórios com as cargas térmicas dos espaços, as potências e caudais das UTA/AHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi mais uma vez compilada no documento *Room Criteria List* (Anexo V) que permitiu redimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o novo PFD-HVAC (Anexo VI).

2.6.2 Simulações

Foi efectuado novo cálculo de energia. Os novos resultados da simulação e respectivas comparações com o modelo original serão apresentados no capítulo 3.

2.7 Modelação das alternativas dos sistemas de AVAC

2.7.1 Chiller e Bomba de Calor

Nesta alternativa manteve-se o edifício original com a envolvente da alternativa que usa os valores de transmissão térmica U que tem por referência o regulamento do país [2].

Foram criados novos sistemas em que as unidades de tratamento de ar passam a ter recuperadores de calor do tipo roda térmica, a produção de água fria passa a ser feita através de um *Chiller* comum a todas as unidades, a produção de água quente passa a ser feita através de uma Bomba de Calor, também comum a todas as unidades, deixando o aquecimento de ser feito exclusivamente por baterias eléctricas e a climatização dos espaços passa a ser feita por Ventilo Convectores a 4 ou 2 tubos, consoante as necessidades de quente ou frio. Mantêm-se as Unidades *split* nas salas eléctricas que necessitam de arrefecimento redundante.

2.7.1.1 Zoning

Os espaços ou conjuntos de espaços foram reorganizados em novas zonas que são controladas pelo mesmo termóstato e partilham os mesmos equipamentos terminais.

2.7.1.2 Spaces

Na janela *Spaces* do HAP introduziram-se os novos dados para as divisões com necessidades de climatização como descrito no documento *Design Criteria* (Anexo II). Como anteriormente, toda esta informação foi compilada no documento Room Criteria List (Anexo V).

2.7.1.3 Sistemas de climatização

O novo sistema de climatização do edifício foi dividido em 3 sistemas independentes que apenas tratam o ar novo necessário para os espaços:

- FAHU 0.1 - Escritórios do R/C
- FAHU 1.1 - Escritórios do 1° andar
- FAHU 1.2 - Salas técnicas

Todos os sistemas são compostos por UTAN/FAHU com recuperação de calor. A água para arrefecimento é produzida por um *Chiller* do tipo Ar-Água (redundante), e a água para o aquecimento é produzida por uma Bomba de Calor do tipo Ar-Água.

A unidade típica é constituída por um recuperador de calor do tipo roda térmica, filtros do tipo A e B na admissão de ar novo, baterias de frio e quente, silenciadores, ventiladores, filtro tipo C na insuflação, humidificador e filtro do tipo A no retorno.

As UTAN/FAHU são responsáveis pelo fornecimento de ar novo e pressurização, bem como pelo tratamento das cargas térmicas do ar novo. O caudal de insuflação é constante.

A climatização dos espaços é feita por unidades locais do tipo ventilo convector a 4 ou 2 tubos.

Dependendo do tipo de sala, poderão ainda existir os seguintes sistemas adicionais:

- Ventiladores de extracção locais - Casas de banho e cozinhas
- Par de ventiladores de extracção redundantes ATEX na sala de baterias.
- Unidades tipo S*plit* nas salas eléctricas que necessitem de arrefecimento redundante.

Cada unidade está equipada na admissão de ar novo por um filtro de areia, Figura 2-5.

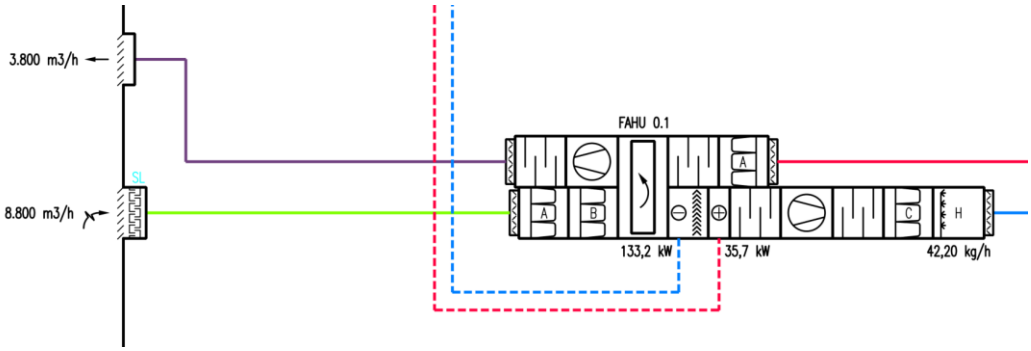

Figura 2-5 - Sistema de climatização tipo – Alt. CH+BC

2.7.1.4 Plants

Criaram-se duas centrais térmicas, uma composta por um *Chiller do tipo Ar-Água* e outra composta por uma Bomba de Calor *do tipo Ar-Água, que p*roduzem respectivamente água fria e água quente para as UTAN/FAHU e para os Ventilo Convectores.

2.7.1.5 Chiller

Criou-se um novo *Chiller* que produz água fria para as UTAN/FAHU e para os Ventilo Convectores. Configuraram-se as temperaturas da água, a temperatura exterior, as características do *Chiller* e a sua eficiência. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do projecto.

2.7.1.6 Bomba de Calor

Criou-se uma nova Bomba de Calor que produz água quente para as UTAN/FAHU e para os Ventilo Convectores. Configuraram-se as temperaturas da água, a temperatura exterior, as características da Bomba de Calor e a sua eficiência. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do projecto.

2.7.1.7 Alternatives

Foi definida uma nova alternativa para o novo sistema. Foram seleccionadas as centrais que fazem parte do edifício em estudo e os sistemas a elas associados. No caso do novo sistema consideraram-se apenas os ventiladores de extracção dos espaços e os perfis de utilização para os ventiladores não foram alterados. Também se mantiveram todas as configurações dos sistemas anteriores para as tarifas.

2.7.1.8 Cálculo de Cargas

Para o novo sistema do edifício foram novamente feitos os cálculos de cargas após o que se obteve os vários relatórios com as cargas térmicas dos espaços, as potências e caudais das UTA/AHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi mais uma vez compilada no documento *Room Criteria List* (Anexo V) que permitiu redimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o novo PFD-IPS (Anexo VI).

2.7.1.9 Simulações

Foi efectuado novo cálculo de energia. Os novos resultados da simulação e respectivas comparações com a alternativa da envolvente serão apresentados no capítulo 3.

2.7.2 Chiller com recuperação

Nesta variante da alternativa anterior apenas se alterou o tipo de central térmica do edifício, ou seja, substituiu-se a combinação *Chiller* e Bomba de Calor por um *Chiller* com recuperação, com o objectivo de usar o calor retirado das salas técnicas, durante o Inverno, para aquecer o ar novo e os espaços que necessitem de aquecimento.

2.7.2.1 Plants

Criou-se uma nova central térmica composta por um *Chiller* com recuperação de calor que produz água fria e água quente para as UTAN/FAHU e para os Ventilo Convectores. Adicionalmente foi necessário criar uma caldeira para apoio ao aquecimento.

2.7.2.2 Chiller

Criou-se um novo *Chiller* com recuperação de calor que produz água fria para as UTAN/FAHU e para os Ventilo Convectores. Configuraram-se as temperaturas da água, a temperatura exterior, as características do *Chiller* e a sua eficiência. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do projecto.

2.7.2.3 Caldeira

Criou-se uma nova Caldeira eléctrica para apoio ao *Chiller* que produz água quente para as UTAN/FAHU e para os Ventilo Convectores quando o *Chiller* não tiver capacidade suficiente.

2.7.2.4 Alternatives

Foi definida uma nova alternativa para o novo sistema. Foram seleccionadas as centrais que fazem parte do edifício em estudo e os sistemas a elas associados. Mantiveram-se todas as configurações dos sistemas anteriores.

2.7.2.5 Cálculo de Cargas

Nesta alternativa em que apenas se alterou a central não há alterações no cálculo de cargas.

2.7.2.6 Simulações

Foi efectuado novo cálculo de energia. Os novos resultados da simulação e respectivas comparações com a alternativa do Chiller e Bomba de calor serão apresentados no capítulo 3.

2.7.3 Humidificador adiabático

Nesta variante da alternativa *Chiller* e Bomba de Calor apenas se alterou o tipo de humidificador, ou seja, substituiu-se o humidificador tradicional, em que a água para humidificação é evaporada numa caldeira eléctrica, por um humidificador adiabático em que a água é pulverizada e em que o único consumo eléctrico é o da bomba do humidificador.

Do relatório da simulação energética foi possível saber: o consumo total de água do humidificador, o consumo de energia eléctrica, o custo de electricidade e as emissões de CO_2, Tabela 2-1.

Tabela 2-1 – Consumos humidificação – Alt. CH+BC

Unit (Electrical)	Load [kg H2O]	Humidifier [kWh]	Cost [€]	CO_2 [kg]
FHAU 0.1	206 136	148 602	10 699	53 497
FHAU 1.1	219 801	158 453	11 409	57 043
FHAU 1.2	77 377	55 781	4 016	20 081
Total	**503 314**	**362 836**	**26 124**	**130 621**

Como referência para o novo cálculo de energia, usou-se o Humidificador LPS 45 da HygroMatik (Anexo IX) cujo consumo eléctrico de referência é de 0,48 kW para uma injecção de água de 45 kg/h. É necessário ainda adicionar uma unidade de tratamento de água por osmose inversa (Anexo IX) cujo consumo de referência é de 0,3 kW para um tratamento de água de 50 l/h. O consumo total de energia dos dois equipamentos é de 16,4 Wh/kg.

Foi efectuado o cálculo dos novos valores. Os novos resultados e respectivas comparações com a alternativa da envolvente serão apresentados no capítulo 3.

Capítulo 3
Apresentação e análise de resultados

Neste capítulo são apresentados e analisados os resultados das quatro hipóteses que foram testadas neste projecto sendo as comparações entre hipóteses apresentadas no capítulo seguinte.

3.1 Apresentação de resultados

3.1.1 Modelo original

3.1.1.1 Custos

A Tabela 3-1 e a Figura 3-1 mostram os resultados dos custos anuais desagregados por tipo de sistema. Os custos estão ainda agrupados em sistemas de AVAC e outros sistemas.

Os maiores custos são os referentes ao aquecimento (40,1%) e arrefecimento (25,3%), seguidos pelos equipamentos eléctricos (18,8%) e ventilação (10,3%).

Relativamente ao AVAC, o maior custo vai ser no aquecimento que é usado não só no Inverno para aquecimento dos espaços e ar novo, mas também no Verão para reaquecimento do ar novo para as salas. Ao contrário do arrefecimento que é feito por Unidades Condensadoras, o aquecimento é 100% eléctrico o que contribui ainda mais para o elevado custo.

O segundo maior consumidor de energia é o arrefecimento que normalmente teria o maior consumo, mas como é feito através de Unidades Condensadoras acaba por ter um menor consumo que o aquecimento.

O custo total anual do sistema de AVAC é de 149 790 €

Tabela 3-1 - Custos anuais por sistema - Original

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	20 295	6,821	10,3
Cooling	50 111	16,842	25,3
Heating	79 383	26,680	40,1
Pumps	0	0,000	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**149 790**	**50,343**	**75,7**
Lights	5 815	1,954	2,9
Electric Equipment	37 144	12,484	18,8
Misc. Electric	5 046	1,696	2,6
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**24,3**
Grand Total	**197 795**	**66,476**	**100,0**

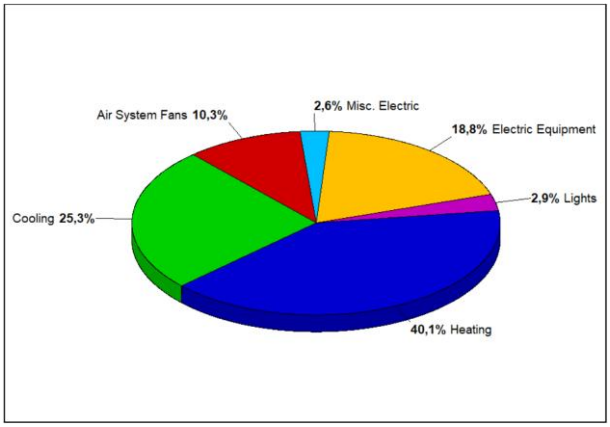

Figura 3-1– Custos anuais por sistema – Original

3.1.1.2 Energia

A Tabela 3-2 mostra as necessidades de energia térmica do edifício e os valores dos consumos eléctricos do edifício.

Como esperado, as necessidades de energia térmica de arrefecimento são muito superiores às necessidades de aquecimento; mas, como explicado anteriormente, devido ao aquecimento eléctrico os consumos de energia eléctrica para aquecimento são superiores aos do arrefecimento, não estando directamente relacionados e não sendo proporcionais.

O consumo energético anual dos sistemas de AVAC é de 2 080 406 kWh.

Tabela 3-2 - Consumo anual de energia por sistema – Original

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 997 008	671,172
Heating Coil Loads	1 046 752	351,802
Grand Total	**3 043 760**	**1022,973**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	281 878	94,736	704 696	236,840
Cooling	695 989	233,914	1 739 972	584,785
Heating	1 102 539	370,551	2 756 347	926,377
Pumps	0	0,000	0	0,000
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**2 080 406**	**699,201**	**5 201 015**	**1748,002**
Lights	80 763	27,143	201 907	67,859
Electric Equipment	515 885	173,383	1 289 712	433,457
Misc. Electric	70 078	23,553	175 196	58,881
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 726**	**224,079**	**1 666 814**	**560,197**
Grand Total	**2 747 131**	**923,280**	**6 867 829**	**2308,199**

3.1.1.3 Emissões

O valor total de emissões anuais de CO_2 é de 988 963 kg, Tabela 3-3

Tabela 3-3 - Emissões equivalentes de CO_2 – Original

Table 3. Annual Emissions

Component	Civil - Control Building
CO2 Equivalent (kg)	988 963

3.1.2 Alternativa da envolvente

3.1.2.1 Custos

A Tabela 3-4e a Figura 3-2 mostram os resultados dos custos anuais desagregados por tipo de sistema. Os custos estão ainda agrupados em sistemas de AVAC e outros sistemas.

Os maiores custos são os referentes ao aquecimento (39,8%) e arrefecimento (24,6%), seguidos pelos equipamentos eléctricos (20,3%) e ventilação (9,4%).

Relativamente ao AVAC, o maior custo vai ser no aquecimento que é usado não só no Inverno para aquecimento dos espaços e ar novo, mas também no Verão para reaquecimento do ar novo para as salas. Ao contrário do arrefecimento que é feito por Unidades Condensadoras, o aquecimento é 100% eléctrico o que contribui ainda mais para o elevado custo.

O segundo maior consumidor de energia é o arrefecimento, que normalmente teria o maior consumo, mas como é feito através de Unidades Condensadoras acaba por ter um menor consumo que o aquecimento.

O custo total anual do sistema de AVAC é de 135 279 €

Tabela 3-4 – Custos anuais por sistema – Alt. Envolvente

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	17 178	5,773	9,4
Cooling	45 177	15,183	24,6
Heating	72 924	24,509	39,8
Pumps	0	0,000	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**135 279**	**45,466**	**73,8**
Lights	5 815	1,954	3,2
Electric Equipment	37 144	12,484	20,3
Misc. Electric	5 046	1,696	2,8
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**26,2**
Grand Total	**183 283**	**61,599**	**100,0**

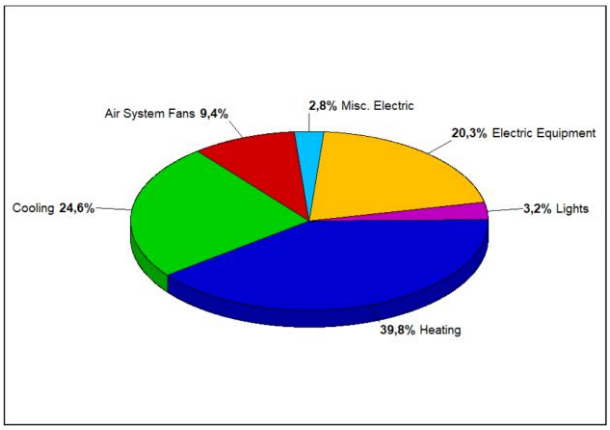

Figura 3-2 – Custos anuais por sistema – Alt. Envolvente

3.1.2.2 Energia

A Tabela 3-5 mostra as necessidades de energia térmica do edifício e os valores dos consumos eléctricos do edifício.

Como esperado, as necessidades de energia térmica de arrefecimento são muito superiores às necessidades de aquecimento; mas, como explicado anteriormente, devido ao aquecimento eléctrico os consumos de energia eléctrica para aquecimento são superiores aos do arrefecimento, não estando directamente relacionados e não sendo proporcionais.

O consumo energético anual dos sistemas de AVAC é de 1 878 861 kWh.

Tabela 3-5 – Consumo anual de energia por sistema – Alt. Envolvente

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 783 123	599,287
Heating Coil Loads	961 669	323,206
Grand Total	**2 744 791**	**922,493**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	238 587	80,186	596 467	200,466
Cooling	627 452	210,879	1 568 629	527,199
Heating	1 012 822	340,398	2 532 056	850,995
Pumps	0	0,000	0	0,000
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 878 861**	**631,464**	**4 697 152**	**1578,660**
Lights	80 763	27,143	201 907	67,859
Electric Equipment	515 885	173,383	1 289 712	433,457
Misc. Electric	70 078	23,553	175 196	58,881
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 726**	**224,079**	**1 666 814**	**560,197**
Grand Total	**2 545 586**	**855,543**	**6 363 966**	**2138,857**

3.1.2.3 Emissões

O valor total de emissões anuais de CO_2 é de 916 423 kg, Tabela 3-6.

Tabela 3-6 - Emissões equivalentes de CO_2 – Alt. Envolvente

Table 3. Annual Emissions

Component	HVAC - Control Building
CO2 Equivalent (kg)	916 423

3.1.3 Alternativa dos sistemas – Chiller e Bomba de Calor

3.1.3.1 Custos

A Tabela 3-7 e a Figura 3-3 mostram os resultados dos custos anuais desagregados por tipo de sistema. Os custos estão ainda agrupados em sistemas de AVAC e outros sistemas.

Os maiores custos são os referentes ao arrefecimento (31,5%) e equipamentos eléctricos (30,4%), seguidos pelo aquecimento (22,6%) e ventilação (9,3%).

Relativamente ao AVAC, nesta alternativa o maior custo vai ser no arrefecimento. O aquecimento deixa de ser o custo mais elevado visto que deixou de ser feito exclusivamente por baterias eléctricas passando a ser feito com recurso a uma Bomba de Calor.

O custo total anual do sistema de AVAC é de 77 428 €

Tabela 3-7 – Custos anuais por sistema – Alt. CH+BC

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	11 308	3,801	9,3
Cooling	38 490	12,936	31,5
Heating	27 603	9,277	22,6
Pumps	27	0,009	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**77 428**	**26,023**	**63,4**
Lights	5 815	1,954	4,8
Electric Equipment	37 144	12,484	30,4
Misc. Electric	1 703	0,572	1,4
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**44 662**	**15,010**	**36,6**
Grand Total	**122 089**	**41,033**	**100,0**

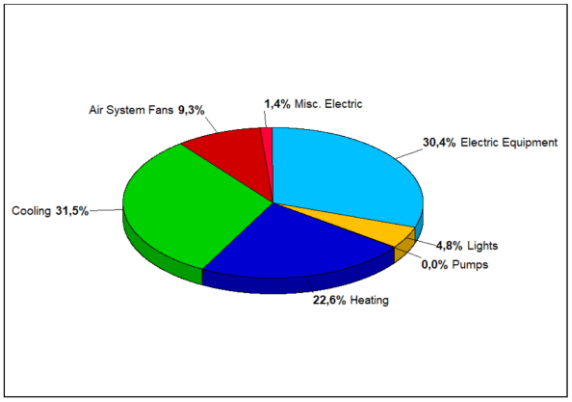

Figura 3-3 – Custos anuais por sistema – Alt. CH+BC

3.1.3.2 Energia

A Tabela 3-8 mostra as necessidades de energia térmica do edifício e os valores dos consumos eléctricos do edifício.

Como esperado, as necessidades de energia térmica de arrefecimento são muito superiores às necessidades de aquecimento e, como explicado anteriormente, devido ao uso da Bomba de Calor os consumos de energia eléctrica para aquecimento são neste caso inferiores aos do arrefecimento.

O consumo energético anual dos sistemas de AVAC é de 1 075 381 kWh.

Tabela 3-8 – Consumo anual de energia por sistema – Alt. CH+BC

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	157 059	52,786	392 647	131,964
Cooling	534 581	179,667	1 336 452	449,166
Heating	383 373	128,847	958 432	322,118
Pumps	369	0,124	923	0,310
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 075 381**	**361,423**	**2 688 453**	**903,559**
Lights	80 760	27,143	201 900	67,856
Electric Equipment	515 885	173,383	1 289 712	433,458
Misc. Electric	23 652	7,949	59 129	19,873
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 296**	**208,475**	**1 550 741**	**521,187**
Grand Total	**1 695 677**	**569,898**	**4 239 194**	**1424,745**

3.1.3.3 Emissões

O valor total de emissões anuais de CO_2 é de 610 449 kg, Tabela 3-9

Tabela 3-9 - Emissões equivalentes de CO_2 – Alt. CH+BC

Table 3. Annual Emissions

Component	IPS - Control Building
CO2 Equivalent (kg)	610 449

3.1.4 Alternativa dos sistemas – Chiller com recuperação

3.1.4.1 Custos

A Tabela 3-10 e a Figura 3-4 mostram os resultados dos custos anuais desagregados por tipo de sistema. Os custos estão ainda agrupados em sistemas de AVAC e outros sistemas.

Os maiores custos são os referentes ao arrefecimento (32,6%) e equipamentos eléctricos (29,9%), seguidos pelo aquecimento (22,3%) e ventilação (9,1%).

Relativamente ao AVAC, nesta alternativa o maior custo continua a ser o arrefecimento seguido do aquecimento.

O custo total anual do sistema de AVAC é de 79 626 €

Tabela 3-10 – Custos anuais por sistema – Alt. CH+REC

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	11 308	3,801	9,1
Cooling	40 553	13,629	32,6
Heating	27 739	9,323	22,3
Pumps	26	0,009	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**79 626**	**26,761**	**64,1**
Lights	5 815	1,954	4,7
Electric Equipment	37 144	12,484	29,9
Misc. Electric	1 703	0,572	1,4
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**44 662**	**15,010**	**35,9**
Grand Total	**124 287**	**41,772**	**100,0**

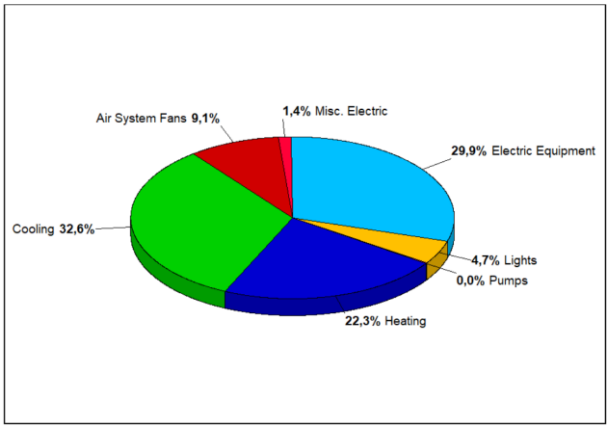

Figura 3-4 – Custos anuais por sistema – Alt. CH+REC

3.1.4.2 Energia

A Tabela 3-15 mostra as necessidades de energia térmica do edifício e os valores dos consumos eléctricos do edifício.

Como esperado, as necessidades de energia térmica de arrefecimento continuam a ser muito superiores às necessidades de aquecimento e, como explicado anteriormente, devido ao uso da Bomba de Calor.

O consumo energético anual dos sistemas de AVAC é de 1 105 906 kWh.

Tabela 3-11 – Consumo anual de energia por sistema – Alt, CH+REC

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	157 059	52,786	392 647	131,964
Cooling	563 227	189,294	1 408 067	473,236
Heating	385 263	129,483	963 158	323,706
Pumps	358	0,120	894	0,300
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 105 906**	**371,683**	**2 764 765**	**929,206**
Lights	80 760	27,143	201 900	67,856
Electric Equipment	515 885	173,383	1 289 712	433,458
Misc. Electric	23 652	7,949	59 129	19,873
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 296**	**208,475**	**1 550 741**	**521,187**
Grand Total	**1 726 203**	**580,157**	**4 315 506**	**1450,393**

3.1.4.3 Emissões

O valor total de emissões anuais de CO_2 é de 621 439 kg, Tabela 3-12

Tabela 3-12 - Emissões equivalentes de CO_2 – Alt. CH+REC

Table 3. Annual Emissions

Component	IPS - HR - Control Building
CO2 Equivalent (kg)	621 439

3.1.5 Alternativa dos sistemas - Humidificador adiabático

A Tabela 3-13 mostra os resultados dos custos anuais e consumos do humidificador adiabático.

A quantidade de água a ser injectadas nas UTAN/FHAU não se alteram, mas os consumos sofrem uma grande redução de 97,7% face a alternativa usada como referência

Tabela 3-13 – Consumos humidificação – Alt. Humidificador adiabático

Unit (Adiabatic)	Load [kg H2O]	Humidifier [kWh]	CO_2 [kg]	Cost [€]
FHAU 0.1	206 136	3 390	1 220	244
FHAU 1.1	219 801	3 615	1 301	260
FHAU 1.2	77 377	1 272	458	92
Total	**503 314**	**8 277**	**2 980**	**596**

3.2 Análise de resultados

3.2.1 Alternativa da envolvente

Estudaram-se dois casos em que a única diferença é o isolamento do edifício. Inicialmente, seguindo os requisitos das normas de Civil, o edifício apenas era isolado na cobertura e as paredes apenas tinham uma caixa de ar. Numa segunda fase foram seguidos os requisitos das normas de AVAC que cumprem a legislação local. Neste caso o isolamento da cobertura tem uma maior espessura e as paredes são isoladas de forma a cumprir com os requisitos mínimos impostos pela legislação.

Como esperado, os ganhos de calor no Verão e as perdas no Inverno diminuíram. Como consequência a potência dos equipamentos diminuiu, bem como os consumos de energia eléctrica.

3.2.1.1 Ventilação – Ar novo e extracção

O ar novo e a extracção não se alteram, visto que os requisitos de ar novo e pressurização não se alteram. As variações registadas são apenas nas salas onde não existe retorno nas UTA/AHU que possuem ventiladores de extracção dedicados (I.S. e cozinha). Nestes casos, como as cargas diminuíram, o ar de insuflação também diminuiu e o ar extraído também diminui proporcionalmente. Ver Tabela 3-14.

Tabela 3-14 – Variação dos caudais de ar novo e extracção – Alt. Env.

Fans	Original		Alt. Envolvente		Delta	
	Min.	Max.	Min.	Max.	Min.	Max.
	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]
EF 0.1.1		200		200	0	0
EF 0.1.2		1 450		1 450	0	0
EF 0.1.3	400	880	400	730	0	-150
EF 0.3		8 350		8 350	0	0
EF 1.1.1		1 850		1 850	0	0
EF 1.1.2	400	970	400	770	0	-200
FAF 0	17 800	18 280	17 800	18 130	0	-150
FAF1	12 450	13 020	12 450	12 820	0	-200
EF 0		3 800		3 800	0	0
EF1		3 700		3 700	0	0

3.2.1.2 UTA/AHU

Com o aumento do isolamento do edifício, as cargas das várias zonas diminuem. Como consequência, diminuem os caudais máximos das unidades, entre 19% e 43% (onde o caudal de ar novo não era suficiente para arrefecer os espaços) e as potências de arrefecimento das unidades diminuem entre 13% e 19%.

No Inverno, com a diminuição das necessidades de aquecimento dos espaços, deixa de haver necessidade de ar de retorno, o ar que entra na bateria de aquecimento é 100% ar novo e está a uma temperatura inferior à do ar com mistura como se verificava no projecto original. Como consequência a potência de pré-aquecimento aumenta.

Por outro lado, como as necessidades de arrefecimento do ar novo diminuem, as necessidades de reaquecimento também diminuem, entre 10% e 29%, e no caso da AHU 1.2 deixa de haver necessidade de reaquecimento. Estes valores são importantes visto que o reaquecimento é eléctrico.

Por fim, com a diminuição dos caudais máximos, as necessidades de humidificação também diminuem, entre 8% e 15%. Ver Tabela 3-15.

Tabela 3-15 – Variação dos caudais e potências das UTA/AHU – Alt. Env.

AHU's			Cooling	Heating (PH/DR)	Pre-Heating Coil	Dehumidifier Reheat	Room Reheating	Humidifier	
	Max.	Electrical						Water	Electrical
	[m³/h]	kW	kW	kW	kW	kW	kW	kg/h	kW
Original									
AHU 0.1	15 940	7,4	173,0	19,7	19,7	14,2	49,8	49,4	37,2
AHU 0.2	15 660	7,3	51,8	15,2	2,3	15,2	4,1	2,9	2,2
AHU 0.3	8 950	4,1	119,2	17,9		17,9		72,2	54,3
AHU 1.1	27 330	12,7	225,6	21,6	21,6	17,6	63,7	62,2	46,7
AHU 1.2	23 820	11,0	127,7	6,6		6,6		28,7	21,6
Alternativa da envolvente									
AHU 0.1	10 690	5,0	140,5	23,2	23,2	12,5	47,9	45,3	34,0
AHU 0.2	12 190	5,9	42,9	10,8	2,3	10,8	4,1	2,9	2,2
AHU 0.3	8 950	4,1	119,2	19,3		19,3		72,2	54,3
AHU 1.1	15 620	7,2	193,7	29,5	29,5	15,9	55,1	54,2	40,7
AHU 1.2	19 360	9,0	111,2	11,0	11,0			24,3	18,2
Delta									
AHU 0.1	-33%	-33%	-19%	18%	18%	-12%	-4%	-8%	-9%
AHU 0.2	-22%	-18%	-17%	-29%	0%	-29%	0%	1%	0%
AHU 0.3	0%	0%	0%	8%		8%		0%	0%
AHU 1.1	-43%	-43%	-14%	37%	37%	-10%	-14%	-13%	-13%
AHU 1.2	-19%	-19%	-13%	67%		-100%		-15%	-16%

3.2.1.3 Custos e Energia

Como visto anteriormente, com a melhoria do isolamento do edifício e a consequente diminuição dos caudais e potências das unidades, os consumos e custos de energia também diminuem. Regista-se uma diminuição de 9,7% nos custos anuais dos sistemas de AVAC e o consumo de energia e as emissões equivalentes de CO_2 do edifício têm uma redução anual de 7,4%. Ver Tabela 3-16

Tabela 3-16 – Variação dos custos e energia – Alt. Envolvente

Simulation	HVAC		Coil Loads		Electrical Energy			Emissions
	Custo		Cooling	Heating	HVAC		Total	CO2 Equiv.
	€	%	kWh	kWh	kWh	%	kWh	kg
Original	149 993	76,7%	1 998 685	1 048 927	2 083 217	75,7%	2 753 449	991 250
Alt. Env.	135 386	73,7%	1 784 046	962 645	1 880 347	73,7%	2 550 579	918 218
Delta	-9,7%		-10,7%	-8,2%	-9,7%		-7,4%	-7,4%

3.2.2 Alternativa dos sistemas - Chiller e Bomba de Calor

Analisaram-se dois casos, alternativa da envolvente e alternativa *Chiller* e Bomba de Calor, em que as diferenças são exclusivamente referentes aos sistemas de AVAC.

As unidades de tratamento de ar passam a ter recuperadores de calor do tipo roda térmica, a produção de água fria passa a ser feita através de um *Chiller* comum a todas as unidades, a produção de água quente passa a ser feita através de uma Bomba de Calor, também comum a

todas as unidades, deixando o aquecimento de ser feito exclusivamente por baterias eléctricas e a climatização dos espaços passa a ser feita por Ventilo Convectores a 4 ou 2 tubos, consoante as necessidades de quente ou frio.

Mantêm-se as unidades tipo S*plit* nas salas eléctricas que necessitam de arrefecimento redundante.

Como esperado, devido ao uso de recuperação de calor nas UTAN/FAHU e ao uso de uma Bomba de Calor em vez de baterias eléctricas, a potência dos equipamentos diminuiu, bem como os consumos de energia eléctrica.

3.2.2.1 Ventilação – Ar novo e extracção

O ar novo e a extracção não se alteram, visto que os requisitos de ar novo e pressurização não se alteram. A única alteração é referente à eliminação dos ventiladores comuns de ar novo e extracção, ver Tabela 3-17.

Tabela 3-17 – Variação dos caudais de ar novo e extracção – Alt. CH+BC

Fans	Alt. Envolvente		Alt. CH+BC		Delta	
	Min.	Max.	Min.	Max.	Min.	Max.
	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]
EF 0.1.1		200		200	0	0
EF 0.1.2		1 450		1 450	0	0
EF 0.1.3	400	730	400	730	0	0
EF 0.3(1.2)		8 350		8 350	0	0
EF 1.1.1		1 850		1 850	0	0
EF 1.1.2	400	770	400	770	0	0
FAF 0	17 800	18 130	-	-	-17 800	-18 130
FAF1	12 450	12 820	-	-	-12 450	-12 820
EF 0		3 800	-	-	0	-3 800
EF1		3 700	-	-	0	-3 700

3.2.2.2 UTAN/FAHU

As unidades AHU 0.2 e AHU 0.3 foram combinadas respectivamente com as unidades FAHU 0.1 e FAHU 1.2 e deixou de haver recirculação de ar, sendo agora a climatização dos espaços feita localmente. Como consequência o caudal de ventilação das unidades diminuiu bem como o consumo da ventilação (apesar da adição dos ventiladores dos Ventilo Convectores).

A potência de frio das unidades também diminuiu, entre 15% e 20%, Tabela 3-18, com excepção da FAHU 1.2 que praticamente mantém a mesma potência.

A potência de quente necessária para reaquecimento diminui, entre 26% e 51%, e no caso da AHU 1.2 deixa de haver necessidade de reaquecimento, visto que as UTAN/FAHU apenas têm de desumidificar o ar novo e deixam de ter a função de arrefecer os espaços.

O aquecimento das UTAN/FAHU 0.1 e 1.1 aumentam, entre 40% e 33% respectivamente, visto que deixaram de existir as baterias de reaquecimento e a temperatura de insuflação do ar novo é agora mais alta. No entanto, como o aquecimento deixa de ser eléctrico, o consumo de energia vai ser menor.

Relativamente a UTAN 1.2 existe um aumento 216%. Apesar dos espaços servidos por esta unidade não necessitarem aquecimento, foi necessário introduzir um bateria de quente para

aquecer ar antes do humidificador visto que o humidificador não conseguiria humidificar o ar novo a baixas temperaturas durante o Inverno.

Com o uso da roda térmica e o arrefecimento local, as necessidades de humidificação também diminuem, entre 12% e 76%.

Tabela 3-18 – Variação caudais e potências das UTAN/FAHU – Alt. CH+BC

AHU's	Fan			Cooling	Heating	Pre-Heating	Dehumidifier	Room	Humidifier	
	Min.	Max.	Electrical		(PH/DR)	Coil	Reheat	Reheating	Water	Electrical
	[m³/h]	[m³/h]	kW	kW	kW	kW	kW	kW	kg/h	kW
Alternativa da envolvente										
AHU 0.1	8 200	10 690	5,0	140,5	23,2	23,2	12,5	47,9	45,3	34,0
AHU 0.2		10 350	4,8	42,9	10,8	2,3	10,8	4,1	2,9	2,2
Total 0.1	**8 200**	**21 040**	**9,7**	**183,4**	**34,0**	**25,5**	**23,3**	**52,0**	**48,2**	**36,2**
AHU 0.3		8 950	4,1	119,2	19,3		19,3		72,2	54,3
AHU 1.2		19 360	9,0	111,3	11,0	11,0	0,0		24,3	18,2
Total 1.2		**28 310**	**13,1**	**230,5**	**30,3**	**11,0**	**19,3**	**0,0**	**96,5**	**72,5**
AHU 1.1	**9 300**	**15 620**	**7,2**	**193,7**	**29,5**	**29,5**	**15,9**	**55,1**	**54,2**	**40,7**
Alternativa *Chiller* e Bomba de Calor										
FAHU 0.1	8 800	8 800	5,0	123,2	35,7	35,7	11,5	0,0	42,2	31,7
AHU 0.2	Included in 0.1									
FC 0.1.X			0,5	33,0	6,6					
Total 0.1	**8 800**	**8 800**	**5,5**	**156,2**	**42,3**	**35,7**	**11,5**	**0,0**	**42,2**	**31,7**
AHU 0.3	Included in 1.2									
FAHU 1.2		12 100	5,6	178,9	34,7	34,7			25,2	18,9
FC 1.2.X			0,9	66,6						
Total 1.2		**12 100**	**6,5**	**245,5**	**34,7**	**34,7**			**25,2**	**18,9**
FAHU 1.1	9 050	9 050	5,0	131,2	39,1	39,1	11,8	0,0	43,4	32,6
FC 1.1.x			0,4	24,3	12,1					
Total 1.1	**9 050**	**9 050**	**5,4**	**155,5**	**51,2**	**39,1**	**11,8**		**43,4**	**32,6**
Delta										
FAHU 0.1	7%	-58%	-44%	-15%	24%	40%	-51%		-12%	-12%
FAHU 1.2		-57%	-50%	7%	15%	216%			-74%	-74%
FAHU 1.1	-3%	-42%	-26%	-20%	74%	33%	-26%		-20%	-20%

3.2.2.3 Custos e Energia

Como visto anteriormente, com as alterações aos sistemas de AVAC, os consumos e custos de energia também diminuem. Regista-se uma diminuição de 42,3% nos custos anuais do sistemas de AVAC e o consumo de energia e as emissões equivalentes de CO_2 do edifício têm uma redução anual de 33,1%, Tabela 3-19.

Tabela 3-19 – Variação dos custos e energia – Alt. CH+BC

Simulation	HVAC		Coil Loads		Electrical Energy			Emissions
	Custo		Cooling	Heating	HVAC		Total	CO2 Equiv.
	€	%	kWh	kWh	kWh	%	kWh	kg
Alt. Env.	135 386	73,7%	1 784 046	962 645	1 880 347	73,7%	2 550 579	918 218
Alt. CH+BC	78 107	63,6%	1 251 822	431 673	1 084 812	63,6%	1 705 108	613 844
Delta	-42,3%		-29,8%	-55,2%	-42,3%		-33,1%	-33,1%

3.2.3 Alternativa dos sistemas - Chiller com recuperação

Analisaram-se dois casos, alternativa do *Chiller* e Bomba de Calor e *Chiller* com recuperação, em que as diferenças são exclusivamente referentes às centrais de AVAC.

Ao contrário do que era esperado, os consumos e custos de energia aumentaram. Regista-se um aumento 2,8% nos custos anuais do sistema de AVAC e o consumo de energia e as emissões equivalentes de CO_2 do edifício têm um aumento anual de 1,8%, Tabela 3-20.

Tabela 3-20 – Variação dos custos e energia – Alt. CH+REC

Simulation	HVAC		Coil Loads		Electrical Energy			Emissions
	Custo		Cooling	Heating	HVAC		Total	CO2 Equiv.
	€	%	kWh	kWh	kWh	%	kWh	kg
Alt. CH+BC	77 428	63,4%	1 251 080	421 723	1 075 381	63,4%	1 695 677	610 449
Alt. CH Rec	79 626	64,1%	1 251 080	421 723	1 105 906	64,1%	1 726 203	621 439
Delta	2,8%		0,0%	0,0%	2,8%		1,8%	1,8%

Como se pode ver na Tabela 3-21, apesar de existir recuperação de calor no Inverno, dado que as salas técnicas necessitam de arrefecimento no Inverno, este calor não é suficiente para suprir todas as necessidades de água quente e, como consequência, a caldeira é necessária para produzir as restantes necessidades de água quente, dai o aumento dos consumos identificados.

Tabela 3-21 – Resultados da simulação da central térmica – Alt. CH+REC

Plant Simulation Results (Table 1) :

Month	Cooling Coil Load (kWh)	Heating Coil Load (kWh)	Plant Cooling Load (kWh)	Plant Heating Load (kWh)	Chiller Output (kWh)	Heat Recovered (kWh)	Boiler Output (kWh)
January	34670	25238	34695	7372	39524	17856	7372
February	35837	9783	35860	4141	38622	5635	4141
March	57503	4179	57528	1785	58620	2390	1785
April	81956	288	81981	83	82020	204	83
May	137700	1353	137725	49	137726	1303	49
June	167141	0	167165	0	167165	0	0
July	196175	1213	196200	34	196200	1178	34
August	182553	16	182578	0	182578	15	0
September	150483	0	150507	0	150507	0	0
October	110746	973	110771	66	110791	906	66
November	58474	6913	58499	2169	59587	4737	2169
December	37843	28753	37868	6732	41749	22012	6732
Total	**1251080**	**78708**	**1251376**	**22431**	**1265089**	**56237**	**22431**

Plant Simulation Results (Table 2) :

Month	Chiller Input (kWh)	Boiler Input - Electric (kWh)	Boiler Misc. Electric (kWh)	Primary Water Dist. Pump (kWh)
January	21609	7372	0	37
February	15526	4141	0	31
March	22392	1785	0	31
April	32017	83	0	27
May	58751	49	0	28
June	77988	0	0	26
July	91013	34	0	28
August	87035	0	0	27
September	67294	0	0	26
October	44238	66	0	28
November	21484	2169	0	33
December	23882	6732	0	37
Total	**563230**	**22431**	**0**	**358**

Apesar de haver alguma recuperação de calor, estes ganhos não são suficientes para compensar o gasto adicional de energia eléctrica da caldeira, fazendo com que no total os consumos eléctricos aumentem relativamente à alternativa do *Chiller* e Bomba de Calor.

Esta alternativa não é, portanto, viável. No entanto é importante salientar que não foi claro, durante este estudo, se as configurações do *software* HAP 6.2 para esta alternativa estariam correctas. Infelizmente, e apesar de várias tentativas, não foi possível esclarecer este aspecto junto do fornecedor do *software*. Pelo que futuramente esta análise poderá ser revista.

Uma possível variante desta alternativa seria usar o Chiller com recuperação combinado com uma bomba de calor de menores dimensões para apoio ao Chiller em substituição da Caldeira

eléctrica. Esta alternativa não foi testada devido a uma limitação do programa que não permite esta configuração.

3.2.4 Alternativa dos sistemas - Humidificador adiabático

Na alternativa usada como referência, o humidificador a vapor necessita de grandes quantidades de energia para evaporar a água a ser injectada nas UTAN/FAHU. Nesta variante da alternativa *Chiller* e Bomba de Calor usou-se um humidificador adiabático em que a água é pulverizada e em que o único consumo eléctrico é o da bomba do humidificador e da unidade de osmose inversa. Como consequência, os consumos eléctricos relativos à humidificação apresentam uma redução significativa, na ordem dos 97,7%, Tabela 3-22

Tabela 3-22 - Variação dos consumos e custos do Humidificador

Unit (Electrical)	Load [kg H2O]	Humidifier [kWh]	CO_2 [kg]	Cost [€]
FHAU 0.1	206 136	148 602	53 497	10 699
FHAU 1.1	219 801	158 453	57 043	11 409
FHAU 1.2	77 377	55 781	20 081	4 016
Total	**503 314**	**362 836**	**130 621**	**26 124**
Unit (Adiabatic)	Load [kg H2O]	Humidifier [kWh]	CO_2 [kg]	Cost [€]
FHAU 0.1	206 136	3 390	1 220	244
FHAU 1.1	219 801	3 615	1 301	260
FHAU 1.2	77 377	1 272	458	92
Total	**503 314**	**8 277**	**2 980**	**596**
Delta	**0,0%**	**-97,7%**	**-97,7%**	**-97,7%**

Regista-se uma diminuição de 33,0% nos custos anuais dos sistemas de AVAC e o consumo de energia e as emissões equivalentes de CO_2 do edifício têm uma redução anual de 20,9%., Tabela 3-23

Tabela 3-23 - Balanço dos consumos do Humidificador

Simulation	AVAC	Electrical		Emissions
	Custo	HVAC	Total	CO2 Equiv.
	€	kWh	kWh	kg
Alt. CH+BC	77 428	1 075 381	1 695 677	610 449
Alt. Humid.	51 900	720 822	1 341 118	482 808
Delta	-33,0%	-33,0%	-20,9%	-20,9%

Capítulo 4
Conclusões

Neste capítulo são apresentados de forma resumida os resultados e as conclusões deste projecto e a sua contribuição para resolver as questões referidas na introdução. São ainda apresentadas recomendações para investigação futura e formas de dar continuidade a este projecto.

O presente projecto teve como objectivo identificar e avaliar medidas de melhoria que pudessem ser implementadas no edifício em estudo, tendo como foco duas áreas de actuação: a envolvente do edifício e o tipo de sistemas de AVAC. Pretendeu-se, portanto, avaliar alternativas com vista a melhorar o desempenho energético do edifício, reduzir o consumo eléctrico e as emissões de CO_2. Do estudo das várias alternativas concluiu-se que:

- Relativamente à envolvente, seguindo os requisitos do regulamento do país, no que respeita aos valores mínimos de transmissão térmica U, foi possível reduzir significativamente os consumos eléctricos e as emissões de CO_2 do edifício. Com a melhoria do isolamento do edifício e a consequente diminuição dos caudais e potências das unidades, registou-se uma diminuição de 9,7% nos custos anuais dos sistemas de AVAC e uma redução anual de 7,4% no consumo de energia e nas emissões equivalentes de CO_2 do edifício.

- Relativamente à alternativa *Chiller* e Bomba de Calor, recorrendo a sistemas que não usam aquecimento eléctrico, em que as UTAN/FAHU apenas tratam o ar novo, o tratamento do ar dos espaços é feito nos próprios espaços e usam um *Chiller* do tipo Ar-Água para produzir água para arrefecimento e uma Bomba de Calor do tipo Ar-Água para produzir água para aquecimento, foi possível reduzir significativamente os consumos eléctricos e as emissões de CO_2 do edifício. Com estas alterações, registou-se uma diminuição de 42,3% nos custos anuais dos sistemas de AVAC e uma redução anual de 33,1% no consumo de energia e nas emissões equivalentes de CO_2 do edifício.

- Relativamente à alternativa *Chiller* com recuperação, quando se substituiu a combinação *Chiller* e Bomba de Calor por um *Chiller* com recuperação e caldeira de apoio, com o objectivo de usar o calor retirado das salas técnicas, durante o Inverno, para aquecer o ar novo e os espaços que necessitem de aquecimento, não foi possível reduzir os consumos eléctricos e as emissões de CO_2 do edifício. Com esta alteração, registou-se um aumento de 2,8% nos custos anuais dos sistemas de AVAC e um aumento anual de 1,8% no consumo de energia e nas emissões equivalentes de CO_2 do edifício.
  Apesar de haver alguma recuperação de calor, os ganhos não foram suficientes para compensar o gasto adicional de energia eléctrica da caldeira. Pelo que se considerou que esta alternativa não seria viável. No entanto, como já referido, é importante salientar que não foi claro, durante este estudo, se as configurações do *software* HAP 6.2 para esta alternativa estariam correctas. Pelo que futuramente se propõe rever esta alternativa.
  Uma possível variante desta alternativa seria usar o *Chiller* com recuperação combinado com uma bomba de calor de menores dimensões para apoio ao *Chiller* em substituição da Caldeira eléctrica. Esta alternativa não foi testada devido a uma limitação do programa que não permite esta configuração.

- Relativamente à alternativa do Humidificador, ao substituir o humidificador tradicional, em que a água para humidificação é evaporada numa caldeira eléctrica, por um humidificador adiabático, em que a água é pulverizada e em que o único consumo eléctrico é o da bomba do humidificador, foi possível reduzir significativamente os consumos eléctricos e as emissões de CO_2 do edifício. Com esta alteração, registou-se uma diminuição de 97,7% nos consumos eléctricos relativos à humidificação. E registou-se uma diminuição de 33,0% nos custos anuais dos sistemas de AVAC e uma redução anual de 20,9% no consumo de energia e nas emissões equivalentes de CO_2 do edifício.

Em resumo, confirma-se que, com melhorias na envolvente do edifício e com a optimização e melhoria da eficiência dos sistemas de AVAC, é possível equilibrar o crescimento das necessidades dos sistemas e satisfazer as mesmas necessidades com um menor consumo de energia.

O projecto original foi feito com base em sistemas tradicionalmente usados na indústria local que, por ainda usarem aquecimento eléctrico, não são os mais ajustados às exigências actuais de eficiência energética e emissões de CO_2. Tendo em conta a tendência actual de crescimento dos consumos na região, sobretudo no sector industrial, estas práticas não são sustentáveis.

Torna-se fundamental uma evolução nas práticas usadas na construção e na concepção dos sistemas de AVAC, em especial nesta região em que o clima é caracterizado por calor extremo e em que as temperaturas médias estão a aumentar ao dobro da velocidade do resto do mundo. Assim, ao usar alternativas como as aqui propostas, é possível contribuir para resolver as questões referidas na introdução deste estudo e que o motivaram, ou seja: o rápido aumento do consumo de electricidade e emissões de CO_2, em particular no que diz respeito aos sistemas de AVAC, e o seu impacto na economia da região.

Faz, portanto, sentido dar continuidade a este projecto no futuro. Propõe-se, por isso, retomar a hipótese do uso de *Chillers* com recuperação de calor, estudar uma alternativa adicional em que se use arrefecimento adiabático e o uso de uma solução de armazenamento de frio (bancos de gelo) em que a produção de frio é feita durante a noite. Propõe-se ainda, futuramente, complementar este estudo com uma análise da viabilidade económica da substituição dos equipamentos originais pelos novos equipamentos propostos.

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Notas:

- Standards do cliente do projecto - Por motivos de confidencialidade a referência ao nome do cliente foi substituída por “Client”
- Standards do país do projecto - Por motivos de confidencialidade a referência ao nome do país foi substituída por “Country”

Anexo I

Relatório Cálculos HAP 6.2

Documento onde se descreve em pormenor a configuração do programa de cálculo Carrier HAP 6.2. O programa foi usado para efectuar os cálculos de cargas e as simulações energéticas das várias alternativas que serviram de base para o estudo.

PEDRO MARIA
ALVES DE JESUS

AVALIAÇÃO DE MEDIDAS DE EFICIÊNCIA ENERGÉTICA NUM EDÍFICIO INDUSTRIAL

Relatório Cálculos HAP 6.2

Novembro de 2025

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1 Introdução

O edifício em estudo é um Edifício de Controlo de uma unidade industrial, com uma área total de pavimento de 2 620 m², distribuída por três pisos e com duas tipologias principais: escritórios e áreas técnicas. O edifício é constituído por: sala de controlo, gabinetes, salas de reuniões, circulações, instalações sanitárias, arrumos, zonas de refeições, salas de oração, salas eléctricas, UPS, baterias, comunicações, servidores e salas de AVAC.

2 Propriedades do Clima (*Weather Properties*)

2.1 Localização

O edifício está localizado num país do Médio Oriente. Por motivos de confidencialidade, a localização exacta não pode ser divulgada por se tratar de um edifício real em que o cliente prefere ficar anónimo. As coordenadas reais e orientação do edifício foram usadas no programa de calculo HAP 6.2.

2.2 Dados climáticos

Utilizou-se a função de *Wizard* do programa para seleccionar os dados climáticos para a localização do edifício, Figura 2-1:

- Local: País do médio oriente
- Altitude: 132 m

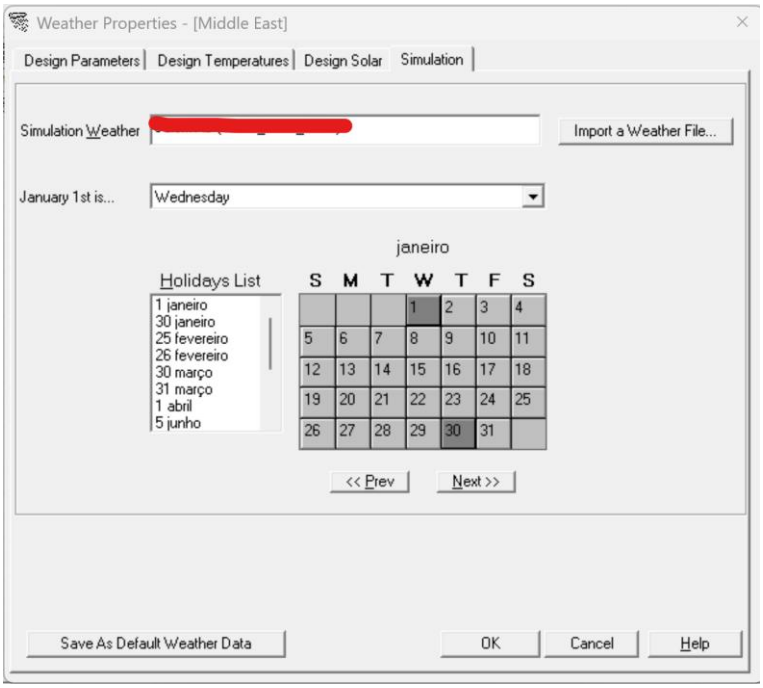


Figura 2-1 - *HAP Weather Simulation data input*

2.3 Temperaturas

As temperaturas exteriores de projecto foram obtidas dos standards do cliente e regulamentos do país. Esta informação foi compilada no documento *Design Criteria* (Anexo II) que faz parte do conjunto dos documentos do projecto original. Esta informação foi introduzida no menu *Weather Properties* do programa, Figura 2-2.

- Temperaturas de Inverno
  - Temperatura de bolbo seco: 4,5 °C
  - Temperatura de bolbo húmido: 2,0 °C
  - Humidade relativa: 64,6%
- Temperaturas de Verão
  - Temperatura de bolbo seco: 51,7 °C
  - Temperatura de bolbo húmido: 28,9 °C
  - Humidade relativa: 18,7%

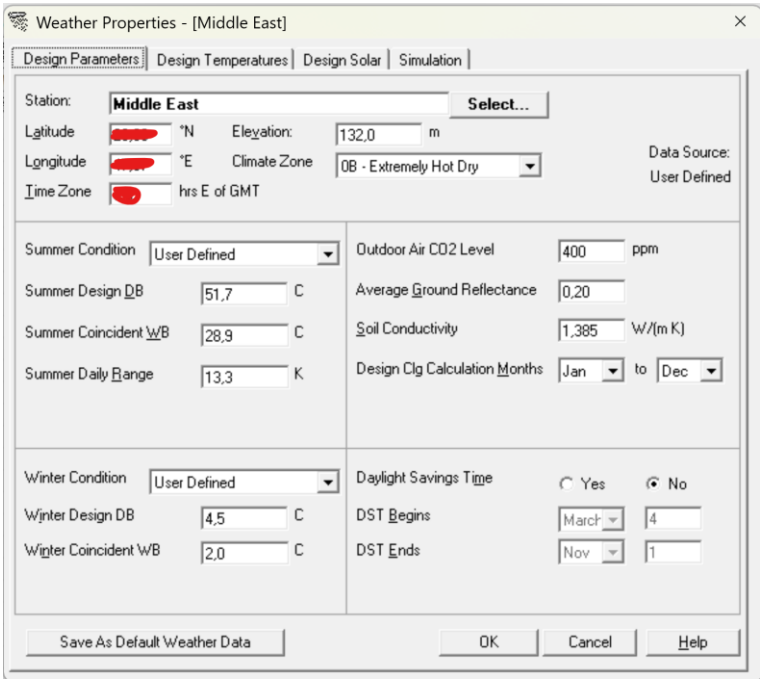


Figura 2-2 – *HAP Design parameters input*

No menu *Weather Properties* do programa definiram-se também a zona horária, o dia de semana do primeiro dia do ano, os feriados aplicáveis ao local e os períodos de hora de Verão e Inverno. No local do edifício não é observada a hora de Verão.

É importante referir que se trata de um edifício de apoio às operações de uma unidade industrial que opera 24 horas por dia, 365 dias por ano. Nos perfis de utilização não foi feita distinção entre dias de semana, fins de semana e feriados.

Para os restantes parâmetros optou-se por utilizar os valores por defeito do programa para o local.

3 Propriedades Geométricas do edifício (*Building Properties*)

Com base nas plantas, cortes e alçados do edifício (Anexo III) construiu-se no HAP 6.2 o modelo do edifício no separador *Building Properties* que contém vários submenus:

3.1 *General*

Foi definido o nome do edifício e as várias alturas das salas (*Floor-to-ceiling, Level-to-Level, Opening Elevation and Raised Floor*), Figura 3-1.

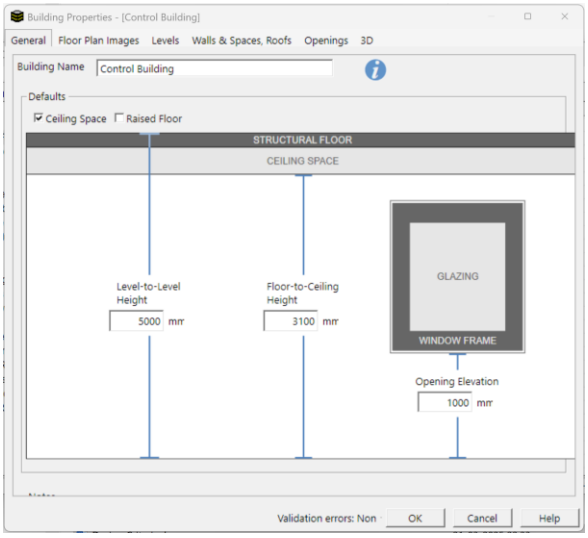


Figura 3-1 – *HAP Building Properties - General*

3.2 *Floor Plan Images*

Foram importadas as plantas dos vários níveis em formato PDF que serviram de base para construir o modelo 3D do edifício, Figura 3-2. Para cada imagem foi ainda configurada a escala e a orientação, Figura 3-3.

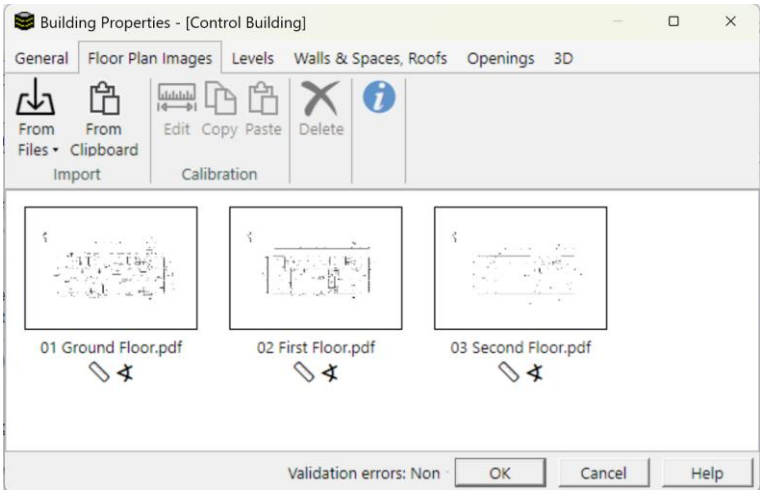


Figura 3-2 – *HAP Building Properties – Floor Plan Images*

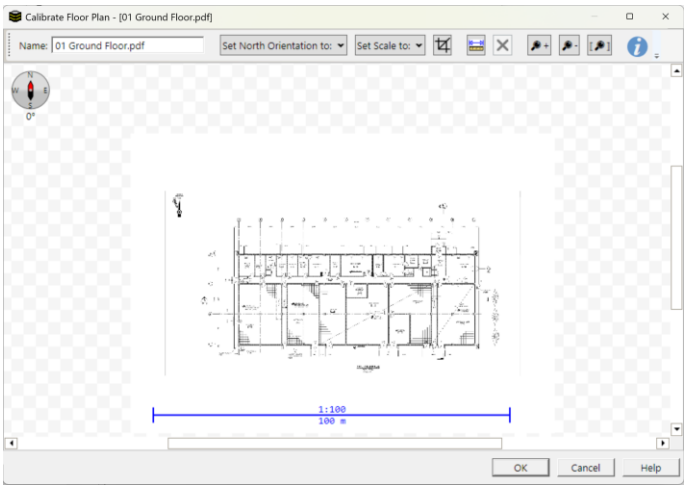


Figura 3-3 – *HAP Building Properties – Calibrate Floor Plans*

3.3 *Levels*

Foram criados os vários níveis, associadas as imagens respectivas, Figura 3-4, e definidas as propriedades dos níveis, Figura 3-5.

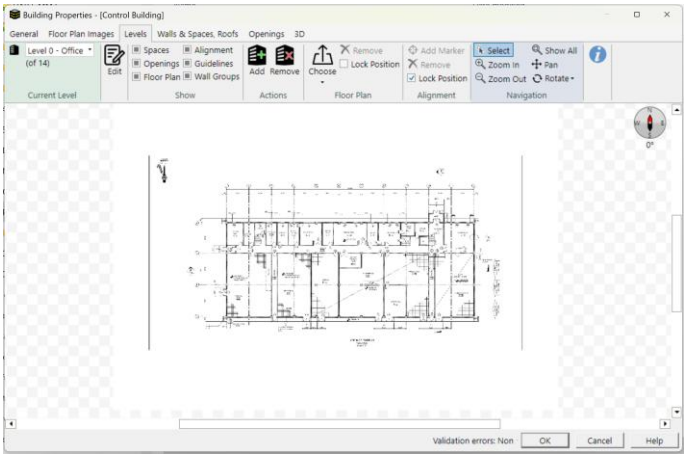


Figura 3-4 – *HAP Building Properties – Levels*

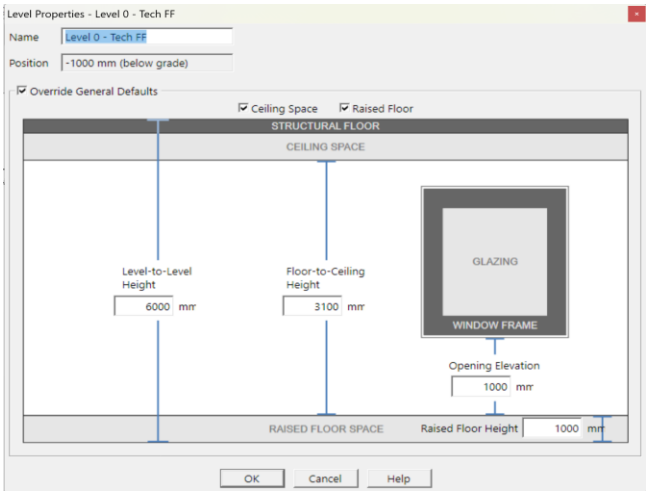


Figura 3-5 – *HAP Building Properties – Level Properties*

3.4 *Walls & Spaces, Roofs*

Desenharam-se as paredes e atribuíram-se os seus tipos (interiores, exteriores, etc.), Figura 3-6. Foram ainda definidos os vários espaços atribuindo-se os respectivos nomes e elevações, Figura 3-7.

Figura 3-6 – *HAP Building Properties – Walls & Spaces, Roofs*

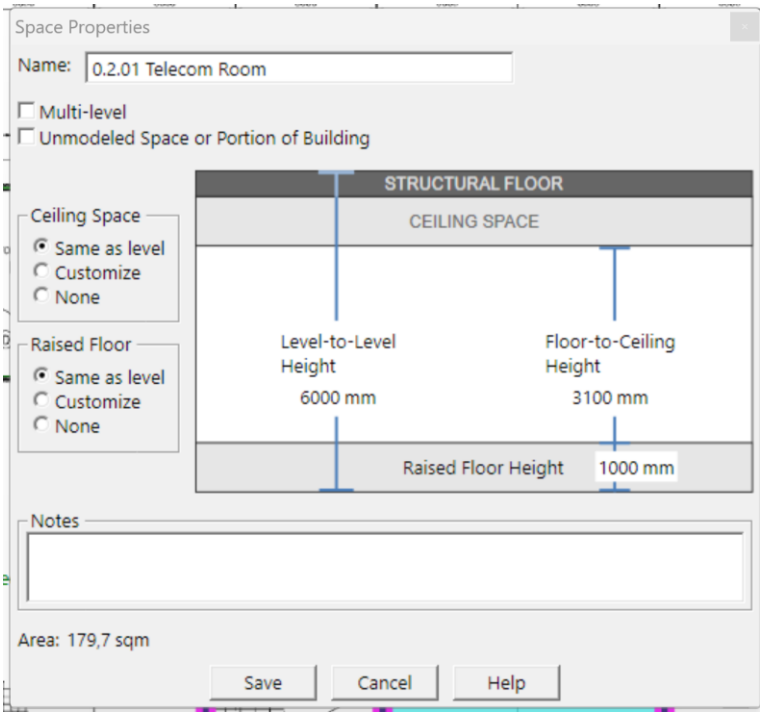


Figura 3-7 – *HAP Building Properties – Space Properties*

3.5 *Openings*

Definiram-se os vários tipos de janelas e portas, Figura 3-8, e adicionaram-se à planta, Figura 3-9.

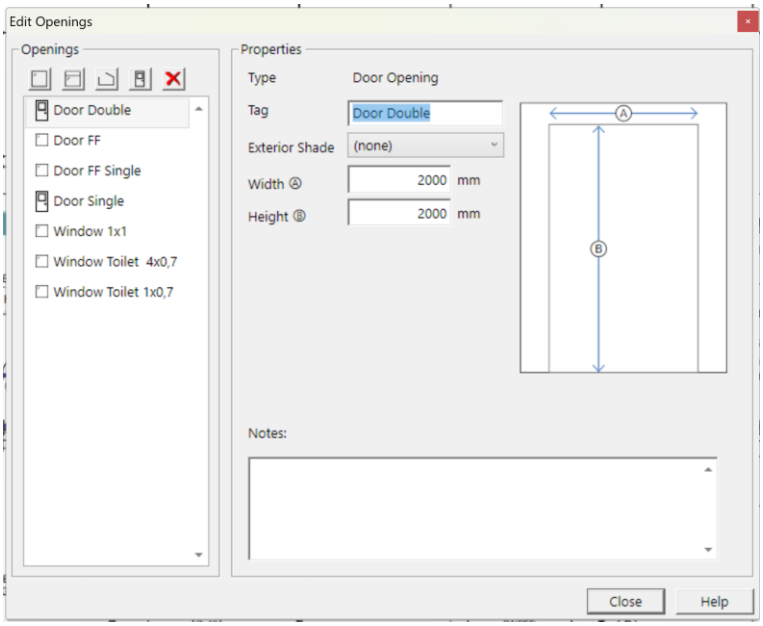


Figura 3-8 – *HAP Building Properties – Edit Openings*

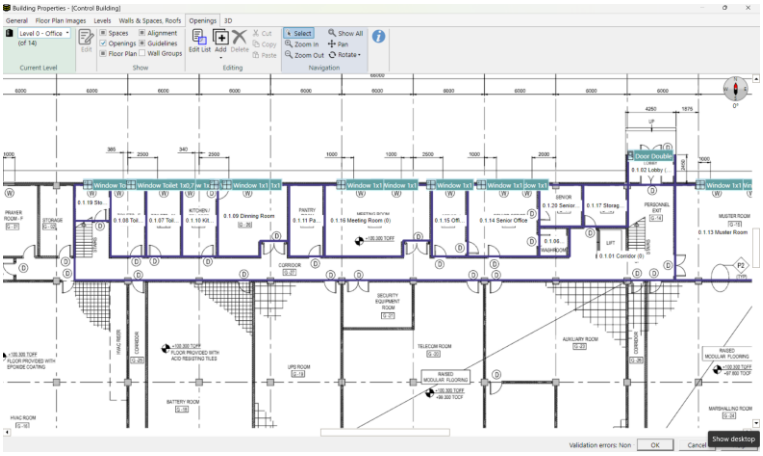


Figura 3-9 – *HAP Building Properties – Openings*

3.6 Modelo 3D

É possível ver o edifício em 3D, Figura 3-10 e Figura 3-11.

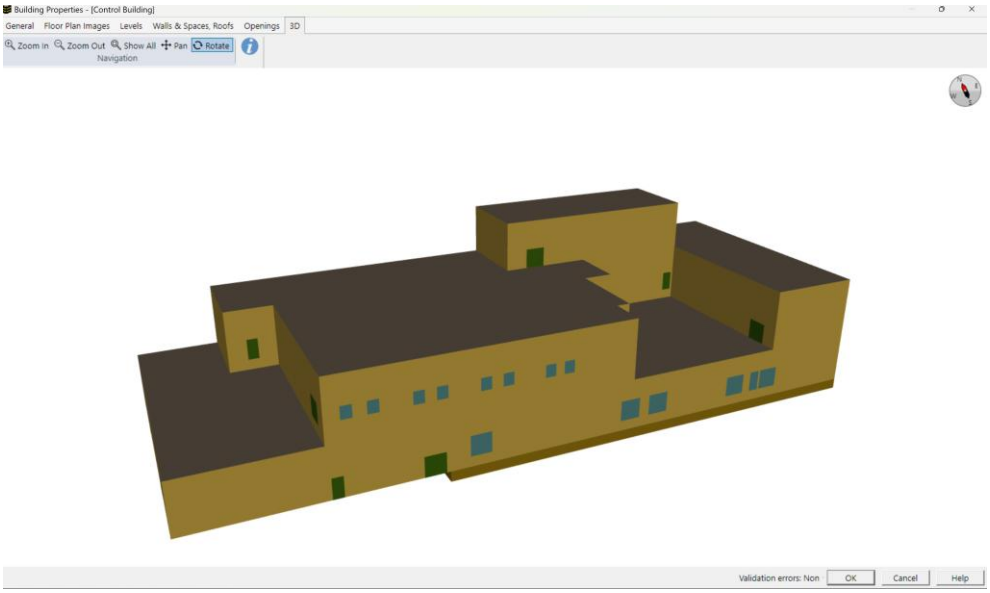


Figura 3-10 – *HAP Building Properties – 3D View 1*

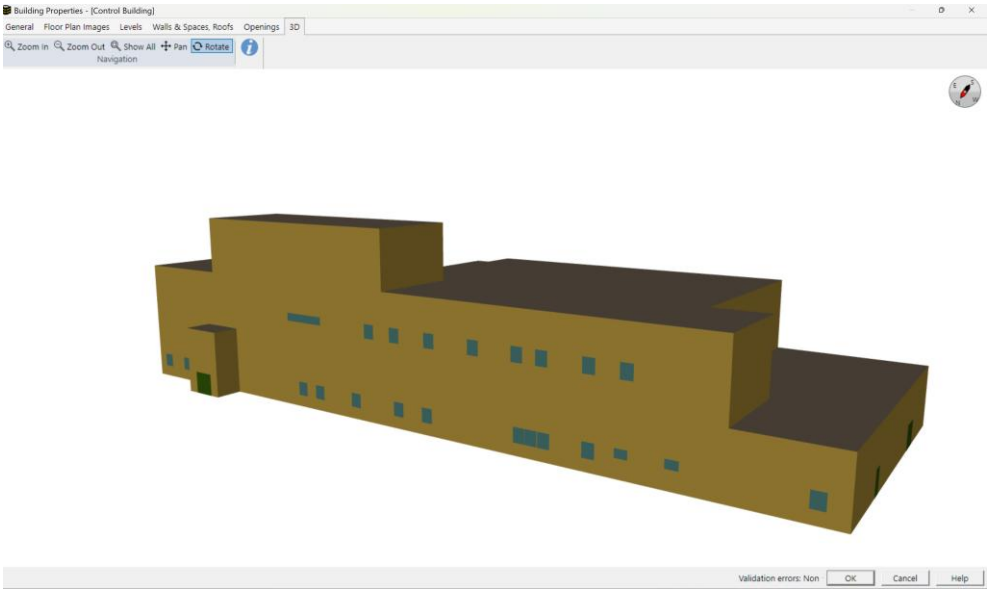


Figura 3-11 – *HAP Building Properties – 3D View 2*

4 Definição da envolvente

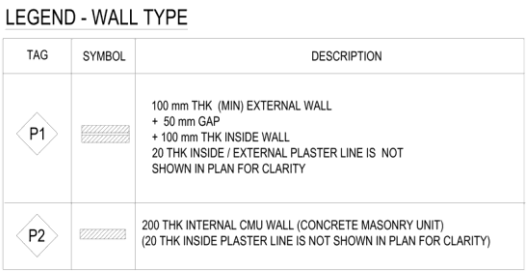
Os requisitos da envolvente do edifício foram obtidos dos standards do cliente e regulamentos do país. Esta informação foi compilada no documento *Design Criteria* (Anexo II) que faz parte do conjunto dos documentos do projecto original.

Os componentes da envolvente do edifício (Paredes Exteriores, Telhados e Pavimentos) dos espaços não climatizados ligados a espaços climatizados devem ter valores U semelhantes aos espaços climatizados.

Os pavimentos com ligação ao exterior devem ter valores U semelhantes aos dos telhados e as divisórias expostas a áreas não climatizadas devem ter valores U semelhantes aos das paredes exteriores.

4.1 Standard Original

Inicialmente para os valores de U (transmissão térmica) usou-se como referência os desenhos de arquitectura (Anexo III), Figura 4-1.


LEGEND - WALL TYPE

TAG	SYMBOL	DESCRIPTION
P1		100 mm THK (MIN) EXTERNAL WALL + 50 mm GAP + 100 mm THK INSIDE WALL 20 THK INSIDE / EXTERNAL PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY
P2		200 THK INTERNAL CMU WALL (CONCRETE MASONRY UNIT) (20 THK INSIDE PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY)

Figura 4-1 – Legenda das paredes nos desenhos - Original

Com base nos desenhos de arquitectura construíram-se os elementos da envolvente descritos na Figura 4-2. Estes dados foram usados na biblioteca de *Assemblies* do HAP. Não sendo possível no programa diferenciar entre paredes, pilares e vigas optou-se por usar um valor médio ponderado para as paredes exteriores. A lista completa dos elementos da envolvente usados no HAP pode ser consultada no documento *Building Envelope Calculations* (Anexo IV).

A envolvente considerada tem os seguintes valores:

- Parede Exterior Média: 1,462 W/m²·K
  - Parede: 1,330 W/m²·K
  - Pilares/Vigas: 1,946 W/m²·K
- Parede Exterior Enterrada: 1,435 W/m²·K
- Parede Interior: 1,442 W/m²·K
- Cobertura: 0,571 W/m²·K
- Pavimentos Contacto Solo: 0,592 W/m²·K
- Pavimentos Interior: 1,742 W/m²·K
- Janelas (1):
  - Transmissão: 3,61 W/m²·K
  - Factor solar: 40%
- Portas: 2,0 W/m²·K

(1) Proporção entre janelas e parede <10%

Exterior Wall - Above grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
290	**TOTAL**				**0,752**
Overall U-Value					**1,330 W/m².°C**

Column / Beam 0.24 m height

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
550	Structural concrete Column/Beam	2,100	2 300	1 265	0,262
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
570	**TOTAL**				**0,514**
Overall U-Value					**1,946 W/m².°C**

Exterior Wall - Above grade - Average

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
4	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	7	0,003
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
3	Projected plaster, 600 to 900 kg/m³	0,300	750	2	0,011
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
257	**TOTAL**				**0,684**
Overall U-Value					**1,462 W/m².°C**

Exterior Wall - Below grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
270	**TOTAL**				**0,697**
Overall U-Value					**1,435 W/m².°C**

Roof

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
100	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	180	0,077
50	Roofmate (XPS)	0,037	32	2	1,351
5	Waterproofing with impregnated flexible membrane with bitumen	0,230	1 050	5	0,022
200	Structural concrete slabs	2,100	2 300	460	0,095
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical upward flow (roofs/floors)	0,000	0	-	0,100
375	**TOTAL**				**1,752**
Overall U-Value					**0,571 W/m².°C**

Floor on/below grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0	-	0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
50	Floormate (XPS)	0,037	32	2	1,351
310	**TOTAL**				**1,689**
Overall U-Value					**0,592 W/m².°C**

Interior Wall

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
240	**TOTAL**				**0,693**
Overall U-Value					**1,442 W/m².°C**

Interior Floor

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
280	**TOTAL**				**0,574**
Overall U-Value					**1,742 W/m².°C**

Figura 4-2 -Envolvente - Original

Nesta fase do projecto não existia informação detalhada sobre as Janelas e Portas, tendo sido usados os valores mínimos de referência definidos no regulamento local, Figura 4-3 e Figura 4-4.

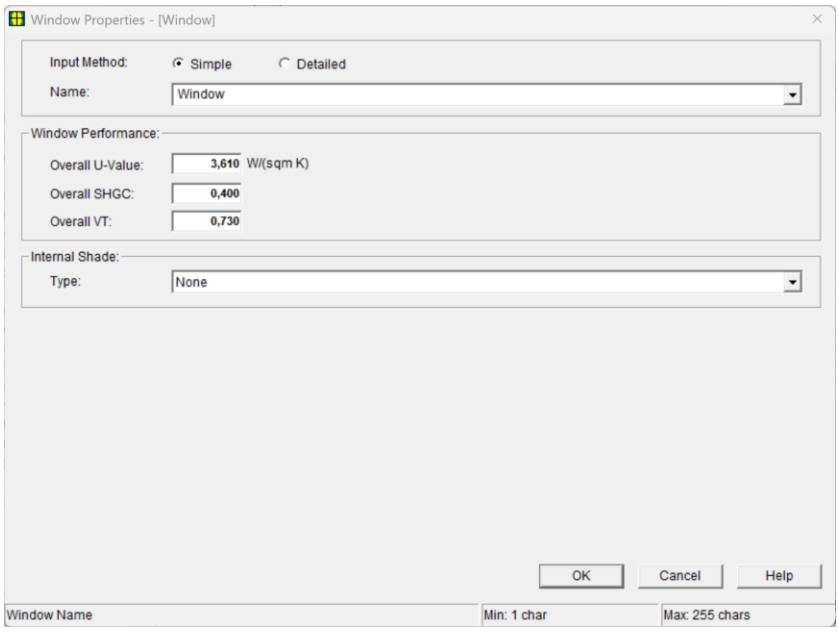


Figura 4-3 - *HAP Window Properties*

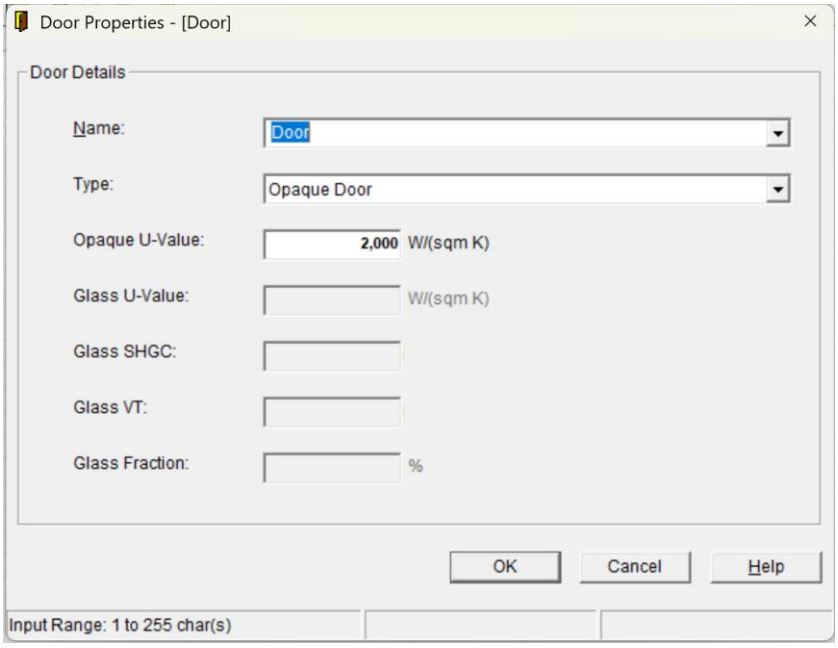


Figura 4-4 - *HAP Door Properties*

5 Propriedades dos espaços (*Space Models*)

5.1 *General*

Foi definido o nome do modelo e associado o edifício que foi modelado, Figura 5-1.

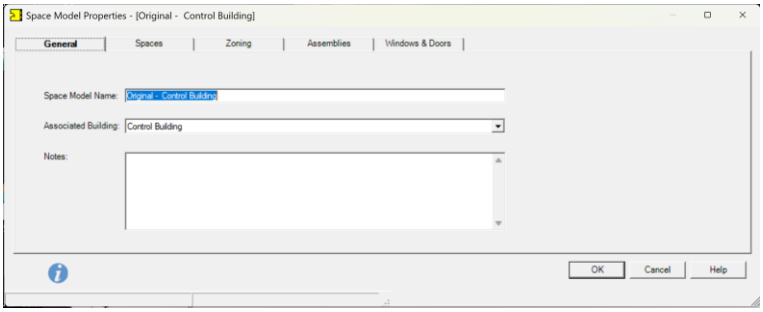


Figura 5-1 – *HAP Space Model Properties – General*

5.2 *Windows & Doors*

A cada tipo de janelas e portas criadas no submenu *Openings* do menu *Building Floor Plans* foi associada a respectiva janela e porta que foram definidas na biblioteca de *Assemblies*, Figura 5-2.

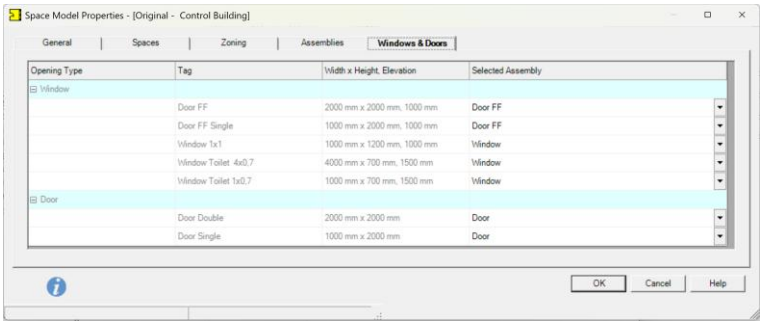


Figura 5-2 - *HAP Space Model Properties - Windows & Doors*

5.3 *Assemblies*

A cada tipo de parede, pavimento e cobertura criadas no submenu *Walls & Spaces, Roofs* do menu *Building Floor Plans* foram associadas as respectivas *Assemblies* que foram definidas na biblioteca de *Assemblies*, .Figura 5-3.

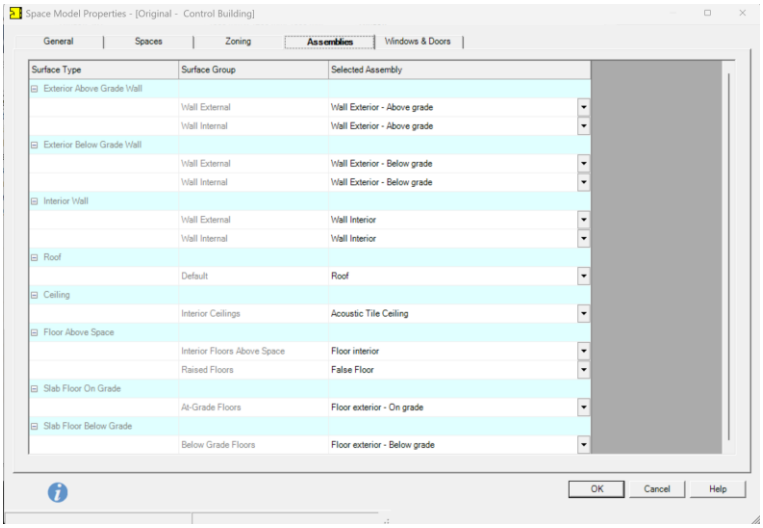


Figura 5-3 - *HAP Space Model Properties - Assemblies*

5.4 *Zoning*

Cada espaço ou conjunto de espaços foram associados a zonas que vão ser controladas pelo mesmo termóstato e partilhar o mesmo equipamento terminal, Figura 5-4.

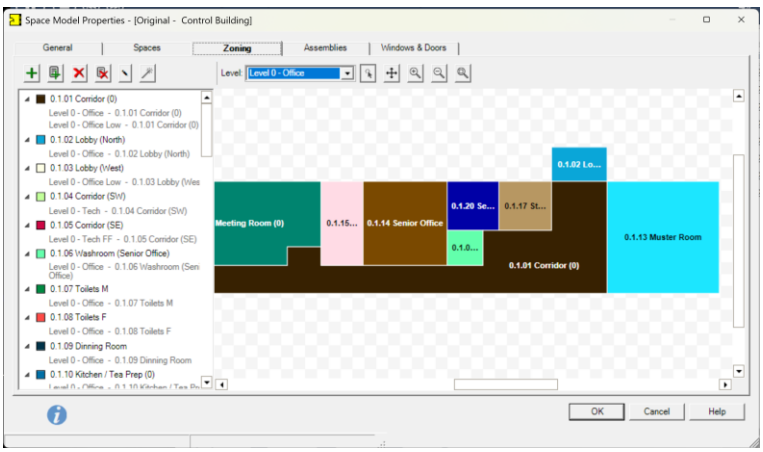


Figura 5-4 - *HAP Space Model Properties - Zoning*

5.5 *Spaces*

Na janela *Spaces* do HAP introduziram-se os dados para as divisões com necessidades de climatização como descrito no documento *Room Criteria List* (Anexo V) que faz parte do conjunto dos documentos do projecto original, Figura 5-5.

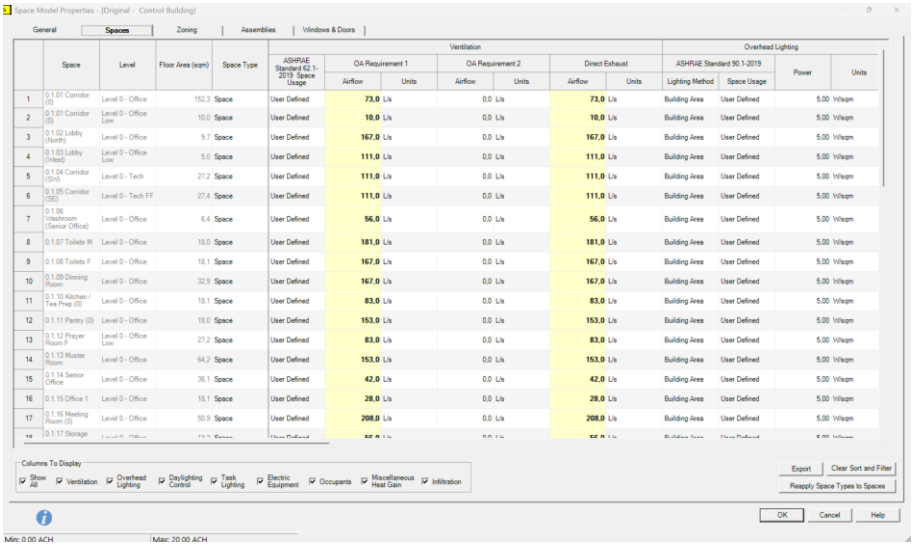


Figura 5-5 - *HAP Space Model Properties - Spaces*

5.5.1 Ventilação

A ventilação funciona 24 h por dia 7 dias por semana, de modo a manter o edifício com uma sobrepressão de 50 Pa e todas as divisões ventiladas com os caudais mínimos indicados nos standards.

5.5.2 Iluminação

Nesta fase do projecto não existia informação detalhada sobre a iluminação, tendo sido assumido que a iluminação é do tipo led com um valor de 5 W/m². A iluminação funciona 24 h por dia 7 dias por semana.

5.5.3 Equipamento eléctrico

A potência dissipada pelos equipamentos foi estimada para os escritórios e fornecida pela especialidade de electricidade e instrumentação para as salas eléctricas. Os escritórios e as salas eléctricas funcionam 24 h por dia 7 dias por semana.

5.5.4 Ocupação

A ocupação dos espaços foi fornecida pela especialidade de arquitectura de acordo com as especificações do cliente. Os escritórios funcionam 24 h por dia 7 dias por semana.

5.5.5 Infiltração

Como o edifício é pressurizado a 50 Pa, não foi considerada infiltração.

6 Sistemas de climatização (*Systems*)

O sistema de climatização do edifício está dividido em 5 sistemas independentes:

- AHU 0.1 - Escritórios do R/C
- AHU 0.2 - Salas de telecomunicações
- AHU 0.3 - Sala de baterias
- AHU 1.1 - Escritórios do 1° andar
- AHU 1.2 - Salas técnicas

Todos os sistemas foram projectados de acordo com os requisitos do cliente e são compostos por UTA/AHU arrefecidas por unidades condensadoras remotas. A unidade típica é constituída por caixa de mistura, filtro do tipo A, baterias de frio de expansão directa redundantes, bateria de aquecimento eléctrica, silenciador, ventilador, silenciador, filtro tipo C e humidificador.

As UTA/AHU são responsáveis pelo fornecimento de ar novo para ventilação e pressurização, bem como pelo tratamento das cargas térmicas do ar novo e dos espaços. Dependendo das necessidades dos espaços, o caudal de insuflação pode ser constante ou variável.

Dependendo do tipo de sala poderão ainda existir os seguintes sistemas adicionais:

- Ventiladores de extracção locais - Casas de banho e cozinhas
- Baterias eléctricas de aquecimento/reaquecimento – Todas as salas
- Par de ventiladores de extracção ATEX na sala de baterias.
- Unidades tipo S*plit* nas salas eléctricas que necessitem de arrefecimento redundante.

Cada central de AVAC está equipada com um conjunto de admissão de ar novo composto por filtro de areia, conjunto de filtros tipo A e B e conjunto de ventiladores redundantes. Existe ainda um par de ventiladores redundantes de extracção, Figura 6-1

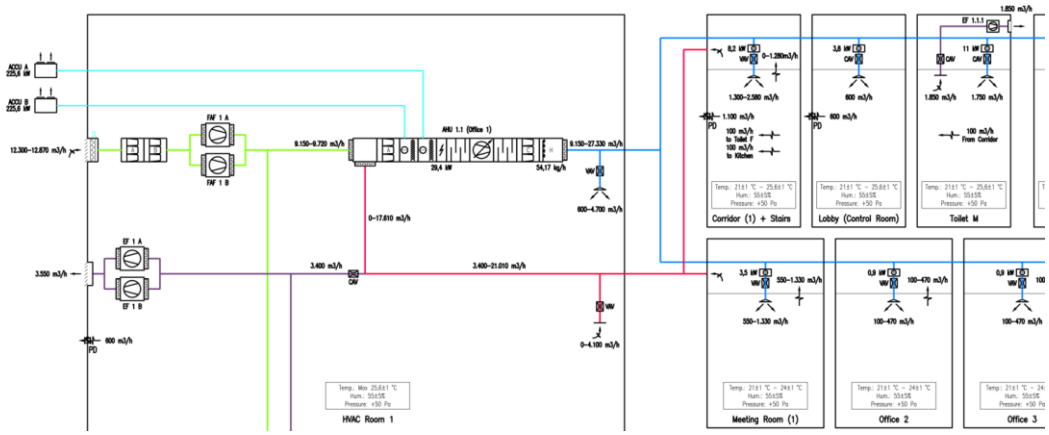


Figura 6-1 - Sistema de climatização tipo - Original

6.1 *General*

Foi definido o nome e tipo do sistema e seleccionado o edifício, Figura 6-2.

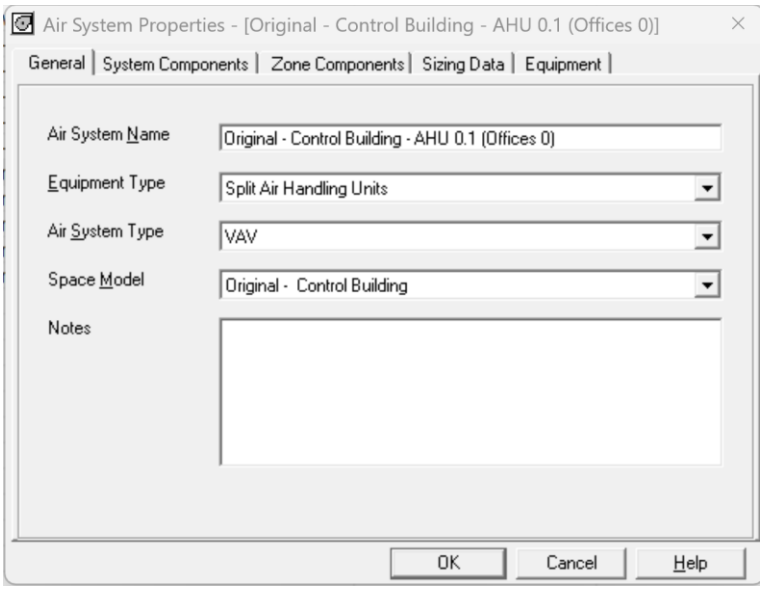


Figura 6-2 - *HAP Air System Properties - General*

6.2 *System Components*

Foram seleccionados e configurados os vários elementos das UTA/AHU, Figura 6-3.

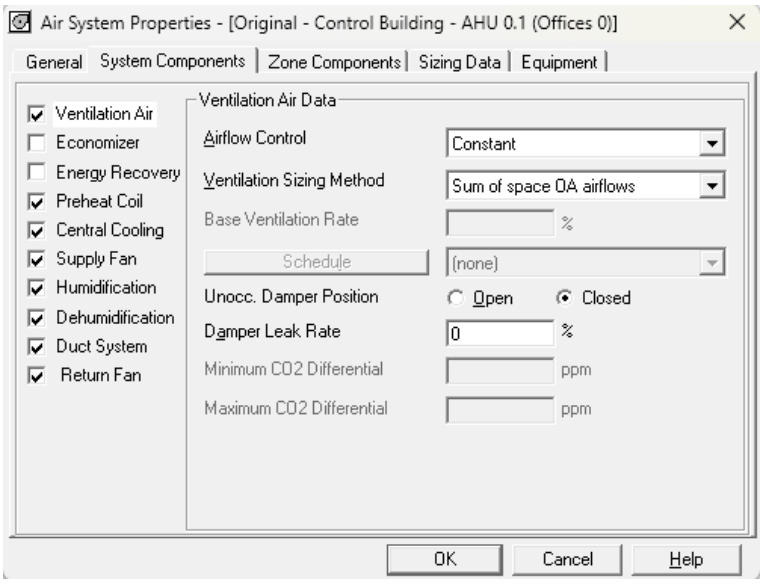


Figura 6-3 - *HAP Air System Properties – System Components*

6.3 *Zone Components*

Foram seleccionadas as zonas tratadas pelas UTA/AHU e configurados os termóstatos e as unidades terminais (baterias de reaquecimento e VAV's), Figura 6-4.

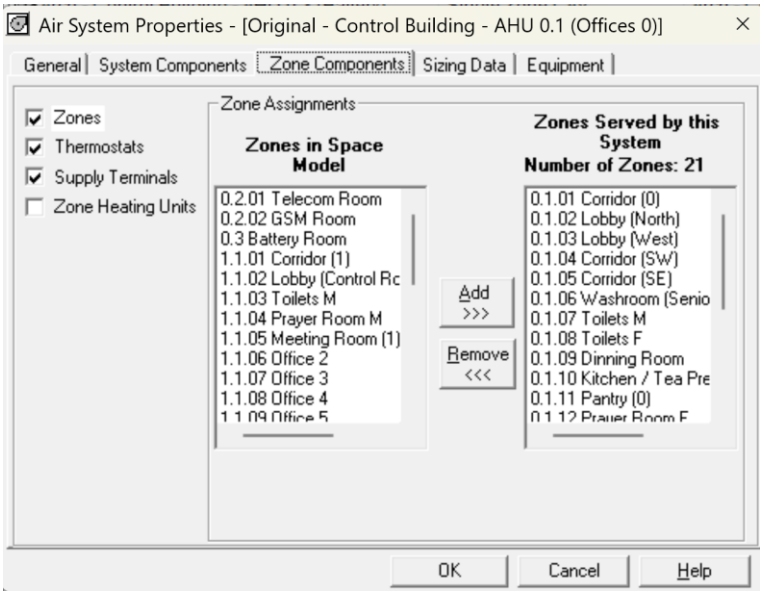


Figura 6-4 - *HAP Air System Properties – Zone Components*

6.4 *Sizing Data*

Foram definidos os factores de segurança, Figura 6-5.

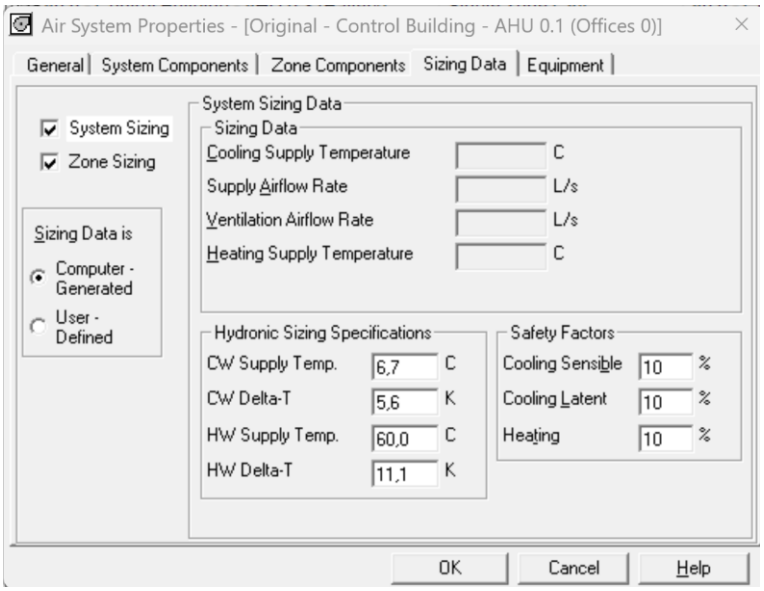


Figura 6-5 - *HAP Air System Properties – Sizing Data*

6.5 *Equipment Data*

Foram definidas as temperaturas de funcionamento das unidades condensadoras e o seu coeficiente de performance. Nesta fase do projecto ainda não foram seleccionadas as unidades finais, tendo sido usados valores retirados de catálogos de equipamentos usados em projectos semelhantes do cliente, Figura 6-6.

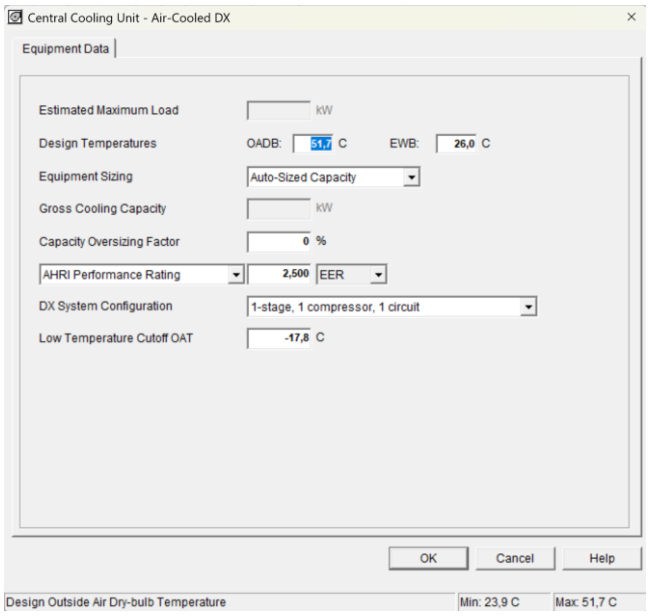


Figura 6-6 - *HAP Air System Properties – Equipment Data*

7 *Alternatives*

No *software* HAP, uma *Alternative* permite, para um cenário de projecto que está a ser estudado, combinar os vários sistemas, centrais, *Space models* e edifícios.

7.1 *General*

Foi definido o nome da alternativa, Figura 7-1.

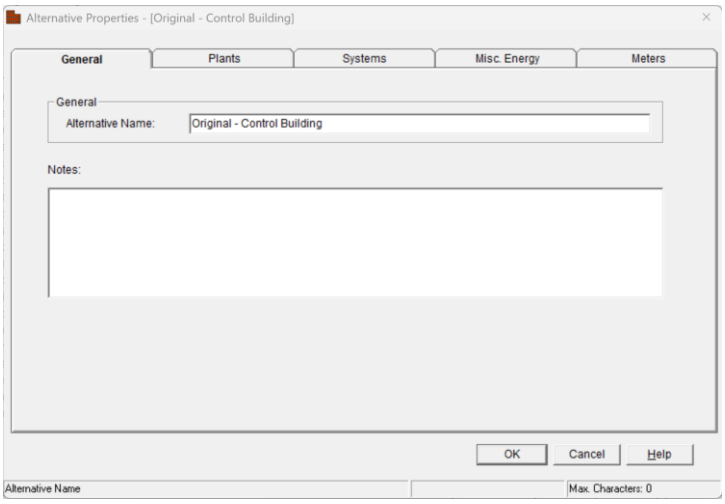


Figura 7-1 - *HAP Alternatives Properties – General*

7.2 *Systems*

Foram seleccionados os sistemas que fazem parte do edifício em estudo, Figura 7-2.

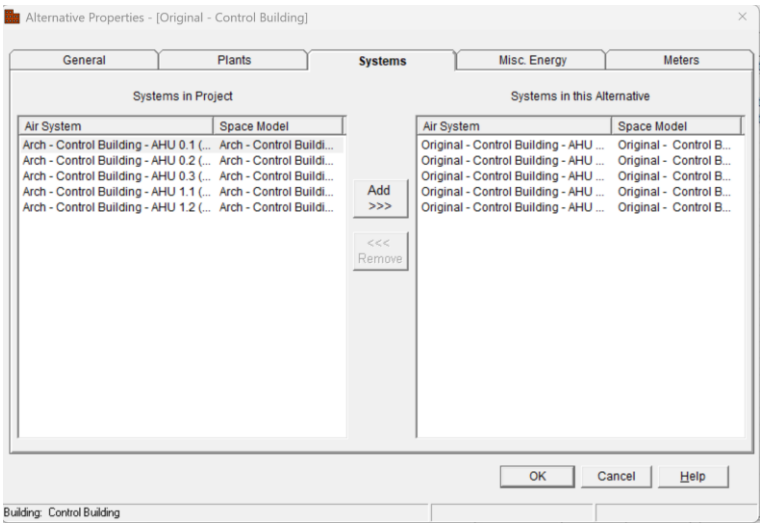


Figura 7-2 - *HAP Alternatives Properties – Systems*

7.3 *Misc. Energy*

No separador *Misc. Energy* consideraram-se todos os equipamentos que consomem energia, mas que não foram considerados nos *Systems*. Estes equipamentos têm consumo de energia, mas não contribuem para as cargas internas dos espaços.

Neste caso consideraram-se os ventiladores de extracção dos espaços e os ventiladores de ar novo e extracção das centrais de AVAC, Figura 7-3

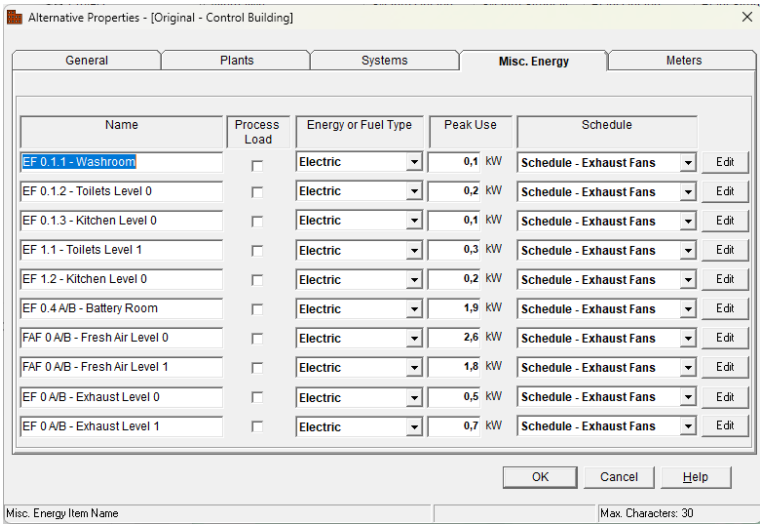


Figura 7-3 - *HAP Alternatives Properties – Misc. Energy*

Por fim foi criado um perfil de utilização para os ventiladores, em que o ventilador funciona a 100%, 24 h por dia e 7 dias por semana todos os dias do ano.

7.4 *Meters*

No separador *Electric Rates* criou-se um perfil novo para as tarifas eléctricas. A tarifa de energia para consumidores não residenciais no local do edifício é de 0,072 €/kWh (valor retirado de fonte da internet para o local do edifício em estudo que não pode ser identificado).

Relativamente ao valor das emissões de CO_2 por kWh, não tendo tido acesso a valores para o local do projecto e para ser possível efectuar comparações, utilizou-se o valor da tabela 107 do manual SCE, cujo factor de conversão de energia primária para emissões de CO_2 no caso da electricidade é de 0,144 $kgCO_2/kWh_{EP}$. Foi necessário ainda converter a energia final para energia primária. O factor de conversão é indicado na tabela 106 do manual SCE e tem o valor de 2,5 kWh_{EP}/kWh. Feita a conversão obteve-se um valor de 0,36 $kgCO_2/kWh$, Figura 7-4.

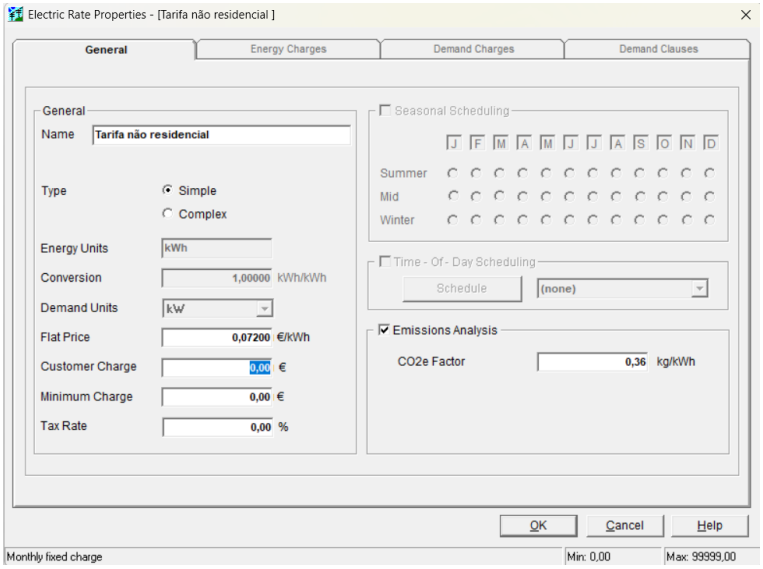


Figura 7-4 - *HAP Electric Rate Properties – General*

No separador *Meters* seleccionou-se a tarifa eléctrica criada no menu *Electric Rates*. Sendo necessário ainda introduzir o factor de conversão de energia final para energia primária que se considerou ser de 2,5 kWh_{EP}/kWh, o que corresponde a uma eficiência de 40%, Figura 7-5.

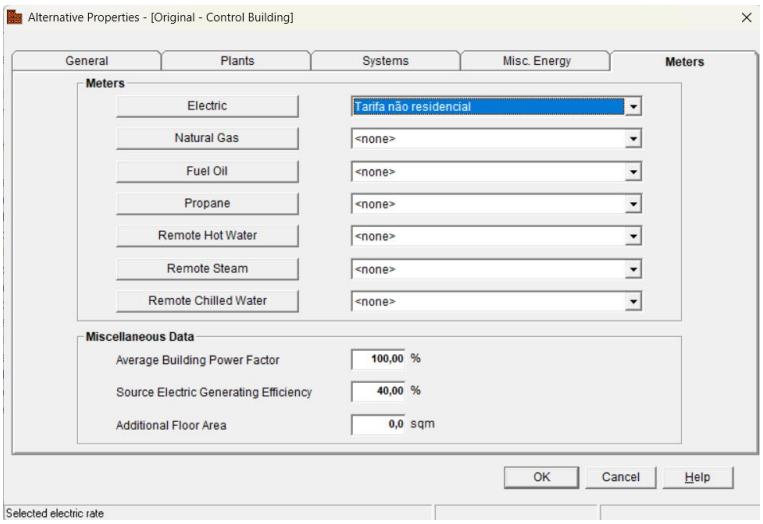


Figura 7-5 - *HAP Alternatives Properties – Meters*

7.5 Cálculo de Cargas (*Design Load Report*)

No separador *Alternatives* selecciona-se "*Print/View Design Load*" que abre o menu "*Design Load Report Options*" onde se seleccionaram os relatórios desejados, Figura 7-6.

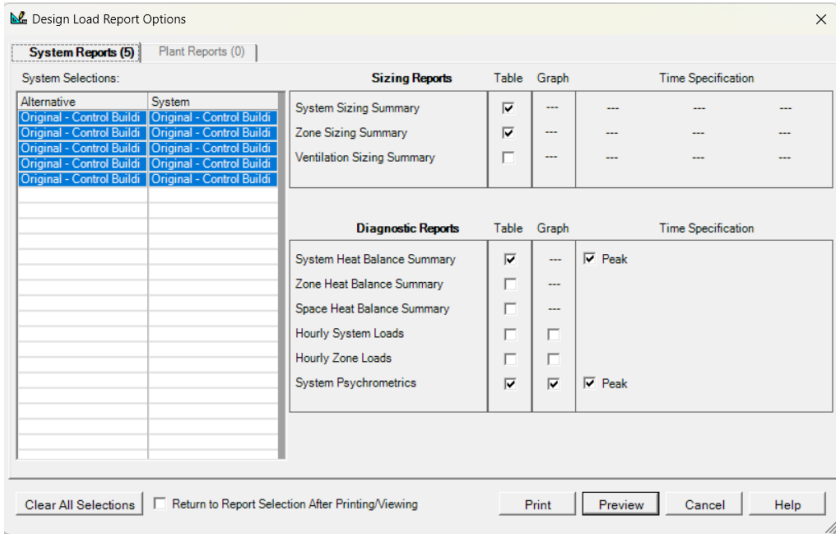


Figura 7-6 - *HAP Design Load Report Options- System Reports*

Para cada sistema do edifício foram feitos os cálculos de cargas, após o que se obteve os vários relatórios com as cargas térmicas dos espaços, as potências e caudais das UTA/AHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi compilada no documento *Room Criteria List* (Anexo V) que permitiu dimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o PFD-Original (Anexo VI).

7.6 Simulações (*Energy Modeling Report*)

Nesta fase todos os dados relativos ao edifício e seus sistemas foram introduzidos no HAP. O cálculo de energia pode ser feito a vários níveis: do edifício, da central ou dos sistemas. No caso dos sistemas usados neste projecto só existem resultados no nível Edifício uma vez que não existem sistemas centralizados.

No separador *Alternatives* seleccionou-se "*Print/View Energy Modeling Results*" que abre o menu "*Energy Modeling Report Options*" onde se seleccionou os relatórios desejados, Figura 7-7.

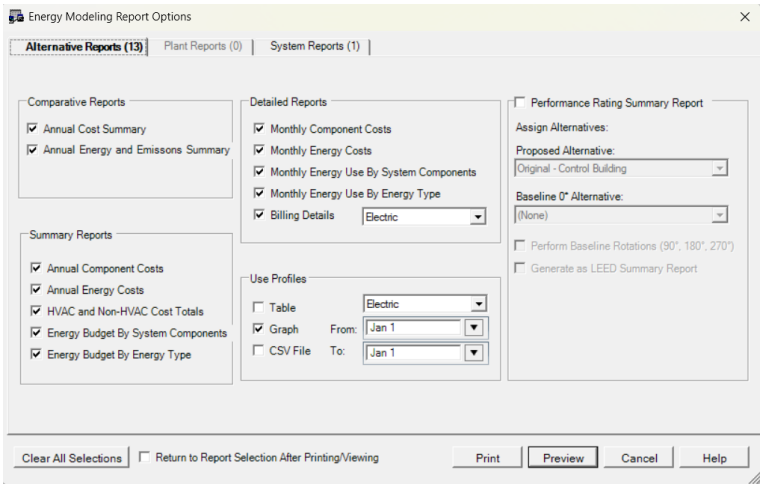


Figura 7-7 - *HAP Energy Modeling Report Options- Alternative Reports*

8 Alternativa da envolvente

Relativamente ao modelo original, nesta alternativa apenas se alteraram os valores de transmissão térmica U, usando-se como referência o regulamento do país.

A envolvente considerada tem de cumprir com os seguintes valores:

- Paredes Exteriores: 0,568 W/m²·K
  - Pilares: 0,568 W/m²·K
  - Vigas: 0,398 W/m²·K
- Cobertura: 0,398 W/m²·K
- Pavimentos: 0,568 W/m²·K
- Janelas (1):
  - Transmissão: 3,61 W/m²·K
  - Factor solar: 40%
- Portas: 2,0 W/m²·K

(1) Proporção entre janelas e parede <10%

Com base nos desenhos de arquitectura construíram-se os novos elementos da envolvente descritos na Figura 8-1. Estes dados foram usados na biblioteca de *Assemblies* do HAP. Não sendo possível no programa diferenciar entre paredes, pilares e vigas optou-se por usar um valor médio ponderado para as paredes exteriores. Como neste caso os valores são muito próximos optou-se por usar um valor de U do pior caso, ou seja, da parede exterior enterrada, Figura 8-2. A lista completa dos elementos da envolvente usados no HAP pode ser consultada no documento *Building Envelope Calculation* (Anexo IV).

Exterior Wall - Above grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
80	Wallmate (XPS)	0,037	30	2	2,162
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
320	**TOTAL**				**2,714**
Overall U-Value					**0,368 W/m².°C**

Column / Beam 0.24 m height

U-Value - ***maximum*** 0,398 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
80	Wallmate (XPS)	0,037	30	2	2,162
550	Structural concrete Column/Beam	2,100	2 300	1 265	0,262
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
570	**TOTAL**				**2,676**
Overall U-Value					**0,374 W/m².°C**

Exterior Wall - Below grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
80	Wallmate (XPS)	0,037	30	2	2,162
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
300	**TOTAL**				**2,659**
Overall U-Value					**0,376 W/m².°C**

Roof

U-Value - ***maximum*** 0,398 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
100	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	180	0,077
80	Roofmate (XPS)	0,037	32	3	2,162
5	Waterproofing with impregnated flexible membrane with bitumen	0,230	1 050	5	0,022
200	Structural concrete slabs	2,100	2 300	460	0,095
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical upward flow (roofs/floors)	0,000	0	-	0,100
405	**TOTAL**				**2,563**
Overall U-Value					**0,390 W/m².°C**

Floor on/below grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0	-	0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
60	Floormate (XPS)	0,037	32	2	1,622
320	**TOTAL**				**1,959**
Overall U-Value					**0,510 W/m².°C**

Interior Wall

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
240	**TOTAL**				**0,693**
Overall U-Value					**1,442 W/m².°C**

Interior Floor

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
280	**TOTAL**				**0,574**
Overall U-Value					**1,742 W/m².°C**

Figura 8-1 -Envolvente – Alt. Envolvente

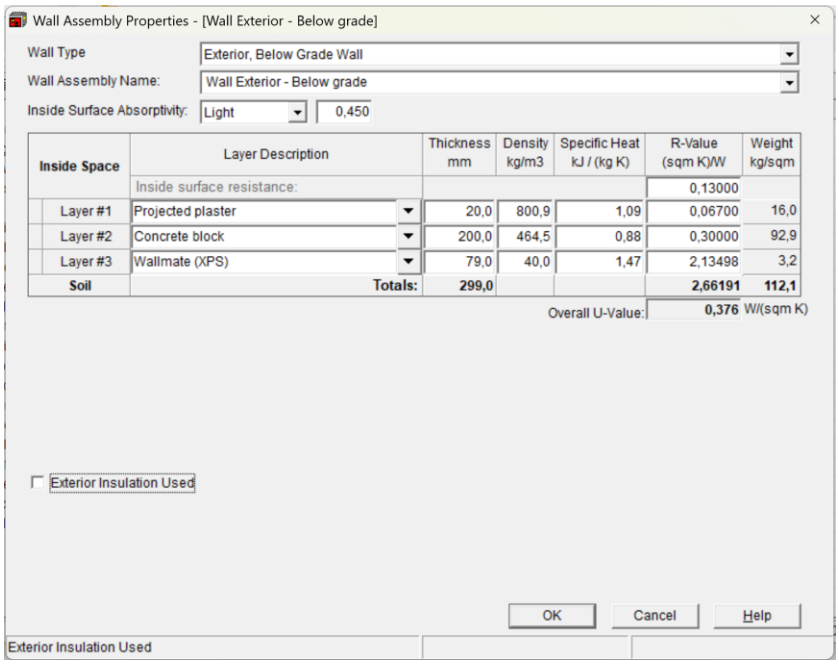


Figura 8-2 - *HAP Wall Assembly Properties* - Parede exterior enterrada

Nesta fase do projecto não existe informação detalhada sobre as Janelas e Portas, tendo sido usados os valores mínimos de referência definidos no regulamento local, Figura 8-3 e Figura 8-4.

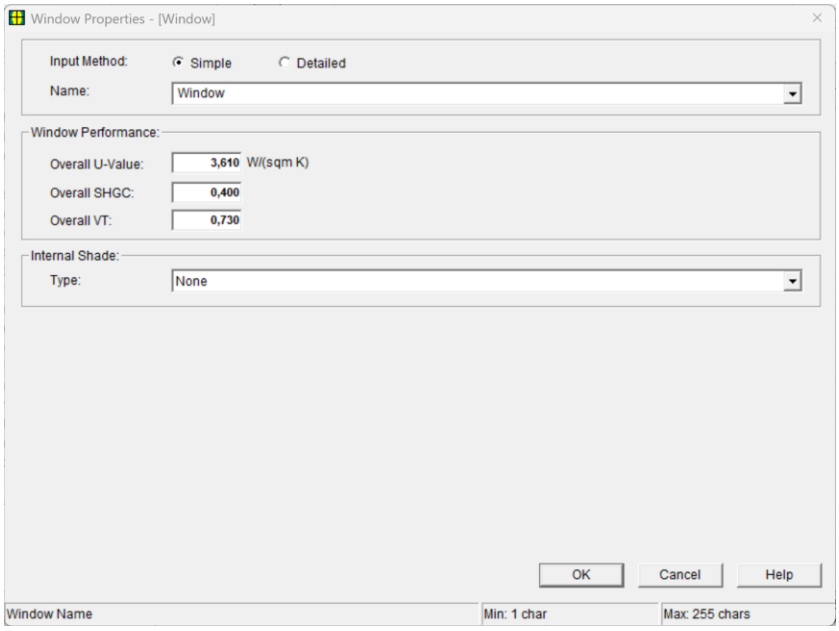


Figura 8-3 - *HAP Window Properties*

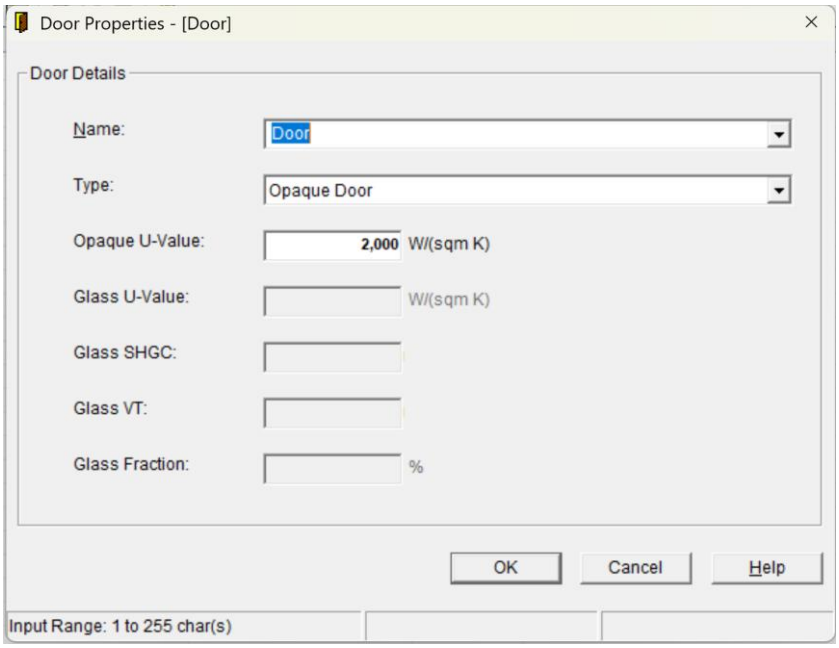


Figura 8-4 - *HAP Door Properties*

8.1 Cálculo de Cargas (*Design Load Reports*)

No separador *Alternatives* selecciona-se "*Print/View Design Load*" que abre o menu "*Design Load Report Options*" onde se seleccionaram os relatórios desejados, Figura 8-5.

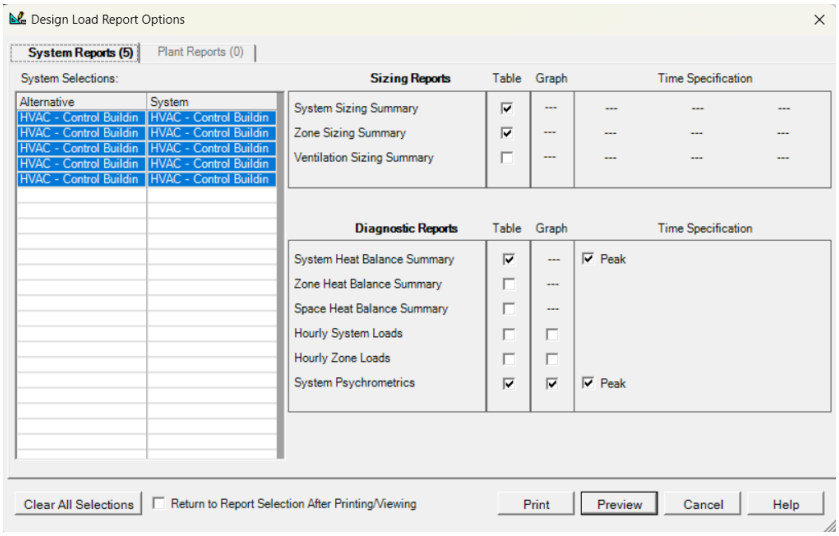


Figura 8-5 - *HAP Design Load Report Options- System Reports*

Para cada sistema do edifício foram feitos os cálculos de cargas, após o que se obteve os vários relatórios com as cargas térmicas dos espaços, as potências e caudais das UTA/AHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi compilada no documento *Room Criteria List* (Anexo V) que permitiu dimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o PFD-Alternativa Envolvente (Anexo VI).

8.2 Simulações (*Energy Modeling Report*)

Nesta fase todos os dados relativos ao edifício e seus sistemas foram introduzidos no HAP. O cálculo de energia pode ser feito a vários níveis: do edifício, da central ou dos sistemas. No caso dos sistemas usados neste projecto só existem resultados no nível Edifício uma vez que não existem sistemas centralizados.

No separador *Alternatives* seleccionou-se "*Print/View Energy Modeling Results*" que abre o menu "*Energy Modeling Report Options*" onde se seleccionaram os relatórios desejados, Figura 8-6.

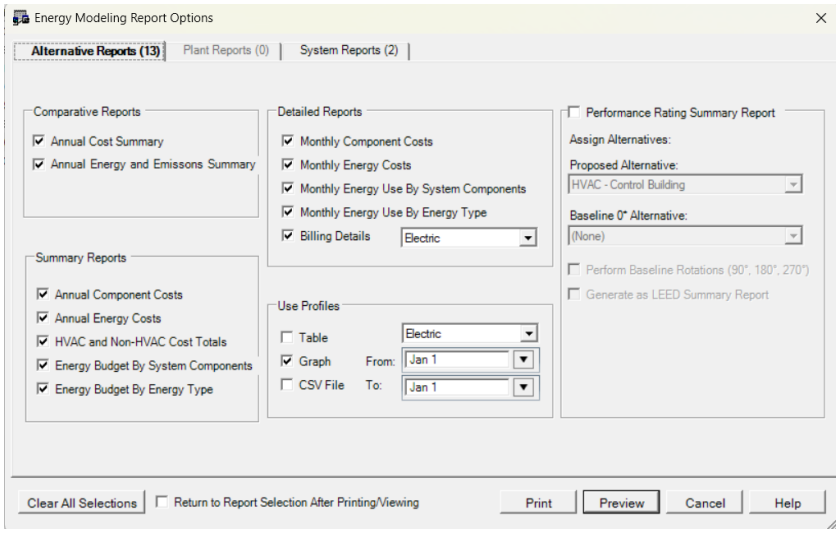


Figura 8-6 - *HAP Energy Modeling Report Options- Alternative Reports*

9 Alternativa dos sistemas de AVAC – *Chiller* e Bomba de Calor

Nesta alternativa manteve-se o edifício original com a envolvente da alternativa que usa os valores de transmissão térmica U que tem por referência o regulamento do país.

Foram criados novos sistemas em que as unidades de tratamento de ar passam a ter recuperadores de calor do tipo roda térmica, a produção de água fria passa a ser feita através de um *Chiller* comum a todas as unidades, a produção de água quente passa a ser feita através de uma Bomba de Calor, também comum a todas as unidades, deixando o aquecimento de ser feito exclusivamente por baterias eléctricas e a climatização dos espaços passa a ser feita por Ventilo Convectores a 4 ou 2 tubos, consoante as necessidades de quente ou frio. Mantêm-se as Unidades tipo *Split* nas salas eléctricas que necessitam de arrefecimento redundante.

9.1 Envolvente do edifício

Para esta parte do estudo foi usada a envolvente alternativa, não tendo sido feitas quaisquer alterações.

9.2 Propriedades dos espaços

Também neste capítulo mantiveram-se as configurações anteriores no que respeita aos menus: *General; Windows & Doors; Assemblies*.

9.2.1 Zoning

Os espaços ou conjuntos de espaços foram reorganizados em novas zonas que vão ser controladas pelo mesmo termóstato e partilhar os mesmos equipamentos terminais que serão também redefinidos em *Air Systems.*

9.2.2 Spaces

Na janela *Spaces* do HAP introduziram-se os novos dados para as divisões com necessidades de climatização como descrito no documento *Design Criteria* (Anexo II). Como anteriormente, toda esta informação foi compilada no documento *Room Criteria List* (Anexo V).

9.3 Sistemas de Climatização (*Systems*)

O novo sistema de climatização do edifício está dividido por 3 sistemas independentes que apenas tratam o ar novo necessário para os espaços:

- FAHU 0.1 - Escritórios do R/C
- FAHU 1.1 - Escritórios do 1° andar
- FAHU 1.2 - Salas técnicas

Todos os sistemas são compostos por UTAN/FAHU com recuperação de calor. A água para arrefecimento é produzida por um *Chiller* do tipo Ar-Água, e a água para o aquecimento é produzida por uma Bomba de Calor do tipo Ar-Água.

A unidade típica é constituída por um recuperador de calor do tipo roda térmica, filtros do tipo A e B na admissão de ar novo, baterias de frio e quente, silenciadores, ventiladores, filtro tipo C na insuflação, humidificador e filtro do tipo A no retorno.

As UTAN/FAHU são responsáveis pelo fornecimento de ar novo e pressurização, bem como pelo tratamento das cargas térmicas do ar novo. O caudal de insuflação é constante.

A climatização dos espaços é feita por unidades locais do tipo ventilo convector a 4 ou 2 tubos.

Dependendo do tipo de sala, poderão ainda existir os seguintes sistemas adicionais:

- Ventiladores de extracção locais - Casas de banho e cozinhas
- Par de ventiladores de extracção redundantes ATEX na sala de baterias.
- Unidades tipo *Split* nas salas eléctricas que necessitem de arrefecimento redundante.

Cada unidade está equipada na admissão de ar novo por um filtro de areia, Figura 9-1.

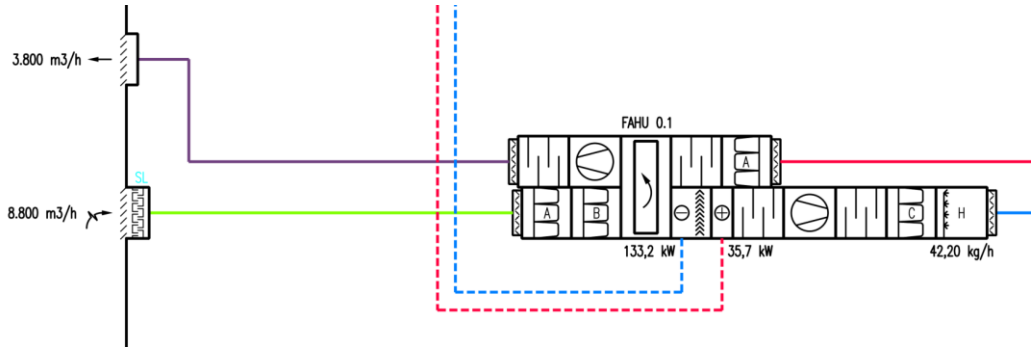


Figura 9-1 - Sistema de climatização tipo – Alt. CH+BC

9.3.1 General

Foi definido o nome e tipo do sistema e seleccionado o edifício, Figura 9-2.

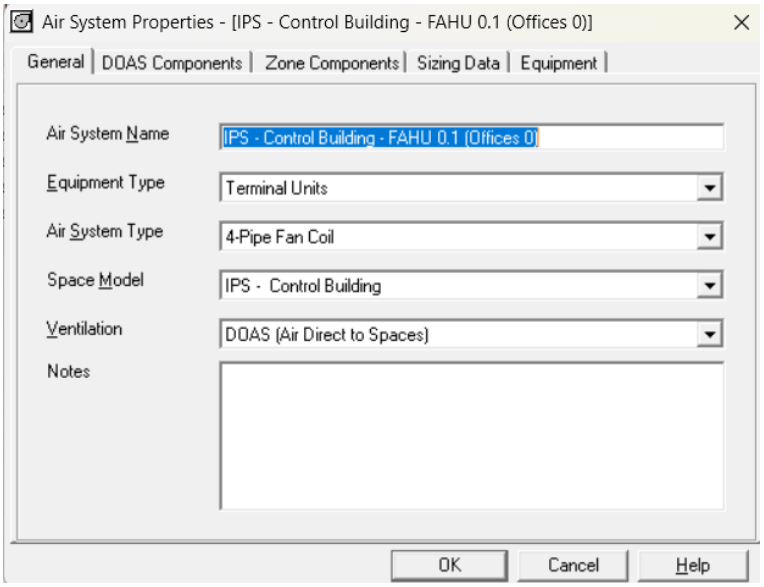


Figura 9-2 - *HAP Air System Properties - General*

9.3.2 System Components

Foram seleccionados e configurados os vários elementos das UTAN/FAHU, Figura 9-3.

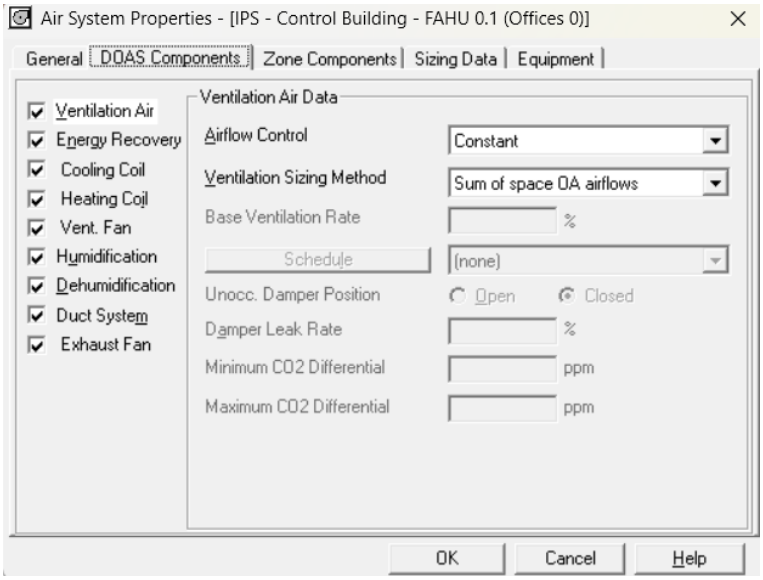


Figura 9-3 - *HAP Air System Properties – System Components*

9.3.3 Zone Components

Foram seleccionadas as zonas tratadas pela UTAN/FAHU e configurados os termóstatos e os Ventilo Convectores, Figura 9-4.

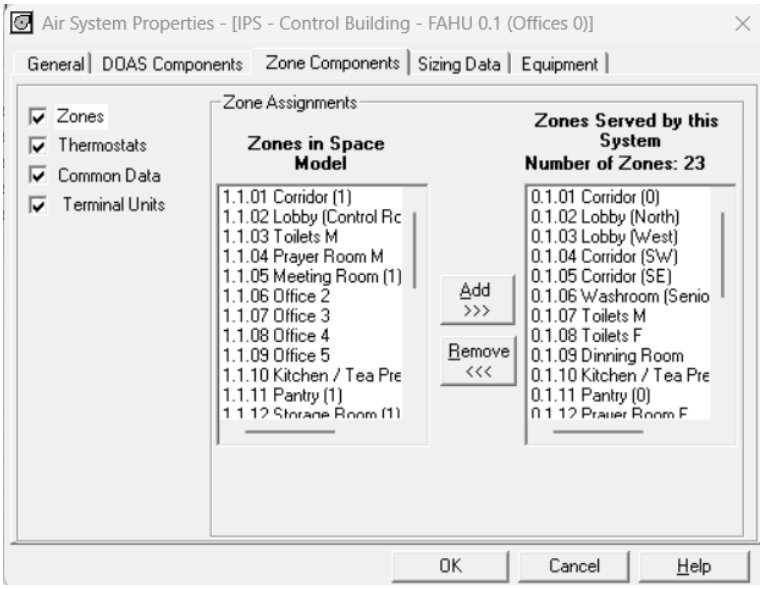


Figura 9-4 - *HAP Air System Properties – Zone Components*

9.3.4 Sizing Data

Foram definidos os factores de segurança e as temperaturas dos fluidos, Figura 9-5.

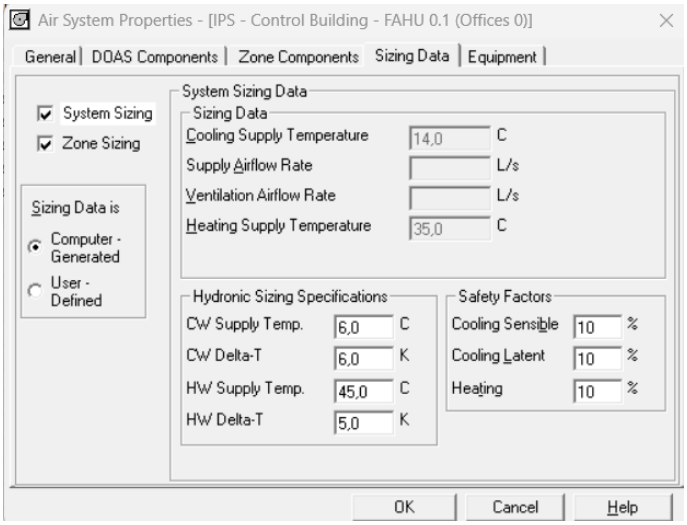


Figura 9-5 - *HAP Air System Properties – Sizing Data*

9.3.5 Equipment Data

As características dos equipamentos foram definidas no menu *Chillers e Plants*.

9.4 Centrais Térmicas (*Plants*)

Para a criação das centrais térmicas no HAP usou-se o menu “Plants / <New Default Plant>”. Criaram-se duas centrais térmicas, uma composta por um *Chiller* do tipo Ar-Água e outra composta por uma Bomba de Calor do tipo Ar-Água, que produzem respectivamente água fria e água quente para as UTAN/FAHU e para os Ventilo Convectores

9.4.1 Plant - Chiller

Esta central é composta por um *Chiller* do tipo Ar-Água, Figura 9-6

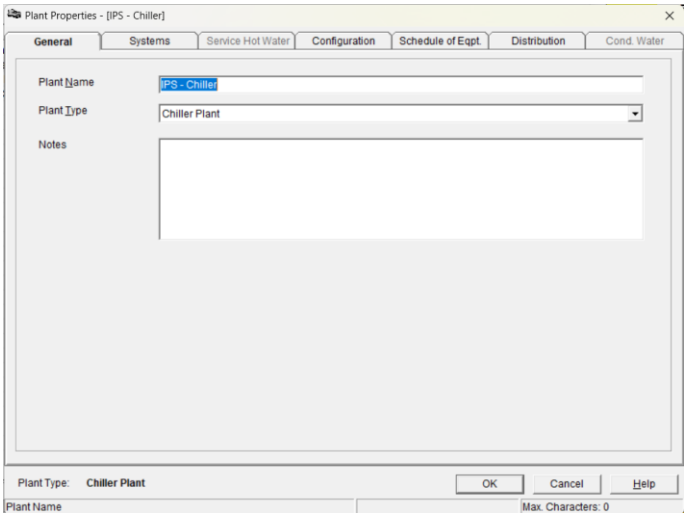


Figura 9-6 - *HAP Plant Chiller – General*

9.4.2 Systems

Foram seleccionados os sistemas que são servidos pela central, Figura 9-7.

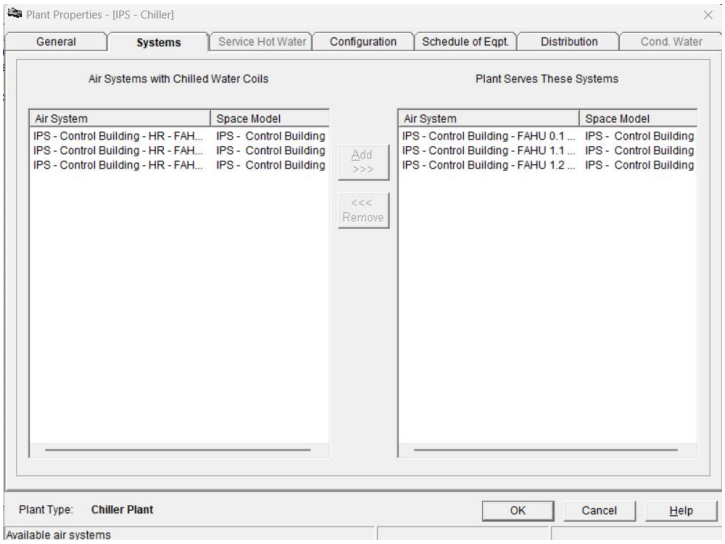


Figura 9-7 - *HAP Plant Chiller – Systems*

9.4.3 Configuration

Neste separador foram configurados os factores de segurança e as temperaturas da água do *Chiller*, Figura 9-8.

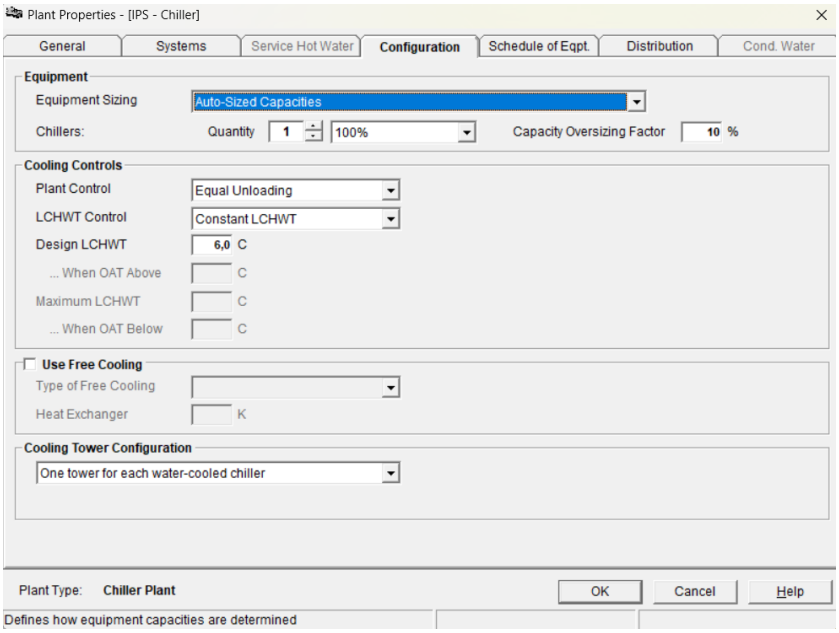


Figura 9-8 - *HAP Plant Chiller – Configuration*

9.4.4 Schedule of Equipment

Neste separador foram seleccionados os equipamentos que servem esta central, Figura 9-9.

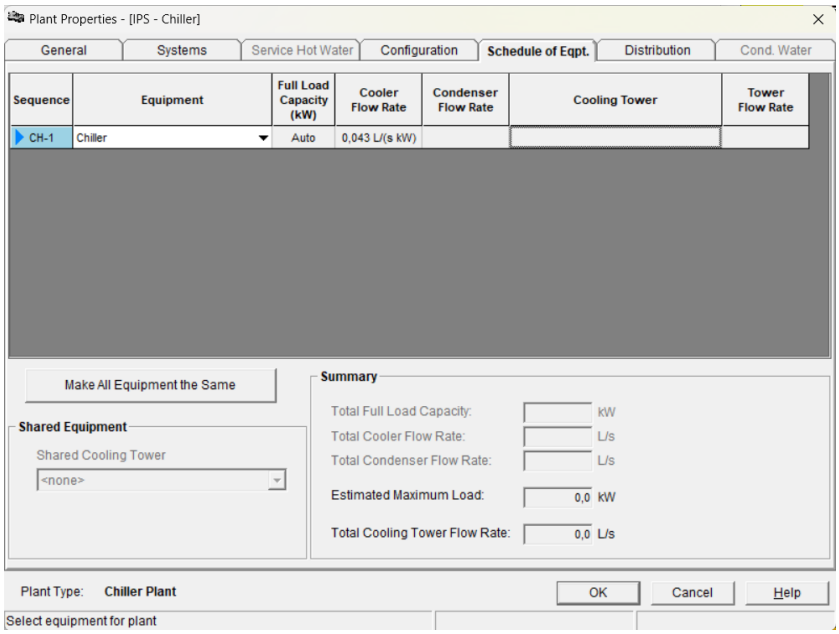


Figura 9-9 - *HAP Plant Chiller – Schedule of Equipment*

9.4.5 Distribution

Neste separador foi seleccionada e configurada a bomba de circulação de água da central, Figura 9-10.

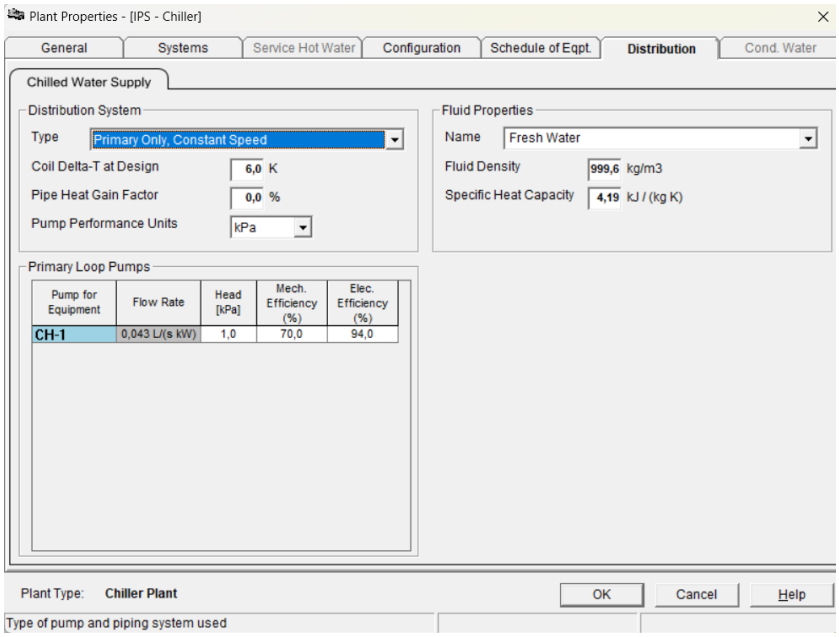


Figura 9-10 - *HAP Plant Chiller – Distribution*

9.4.6 Plant – Heat Pump

Esta central é composta por uma Bomba de Calor do tipo Ar-Água, Figura 9-11

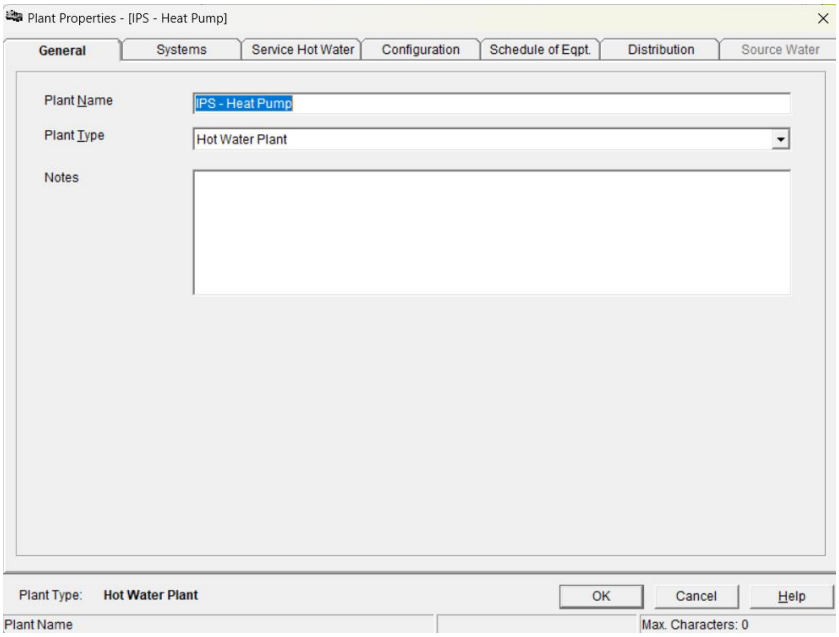


Figura 9-11 - *HAP Plant Bomba de Calor – General*

9.4.7 Systems

Foram seleccionados os sistemas que são servidos pela central, Figura 9-12.

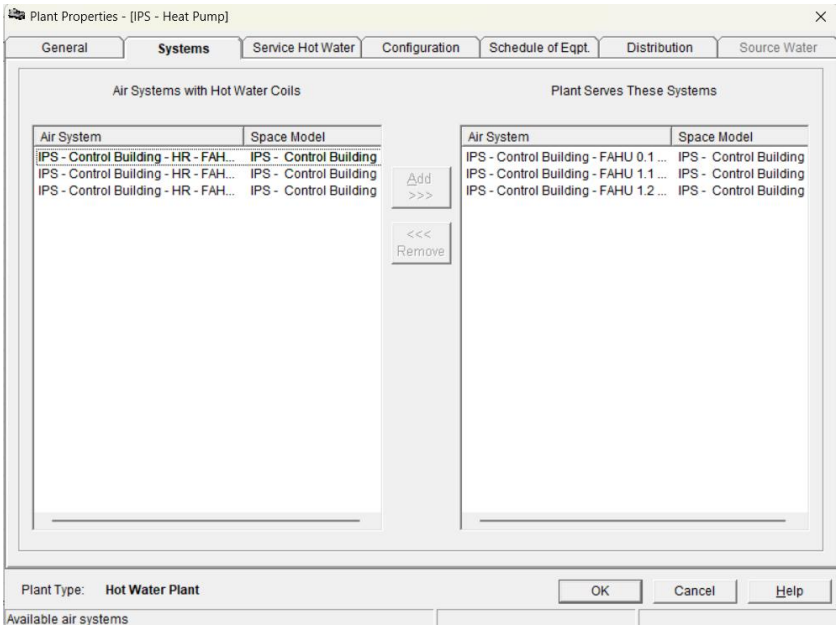


Figura 9-12 - *HAP Plant Bomba de Calor – Systems*

9.4.8 Configuration

Neste separador foram configurados os factores de segurança e as temperaturas da água da Bomba de Calor, Figura 9-13.

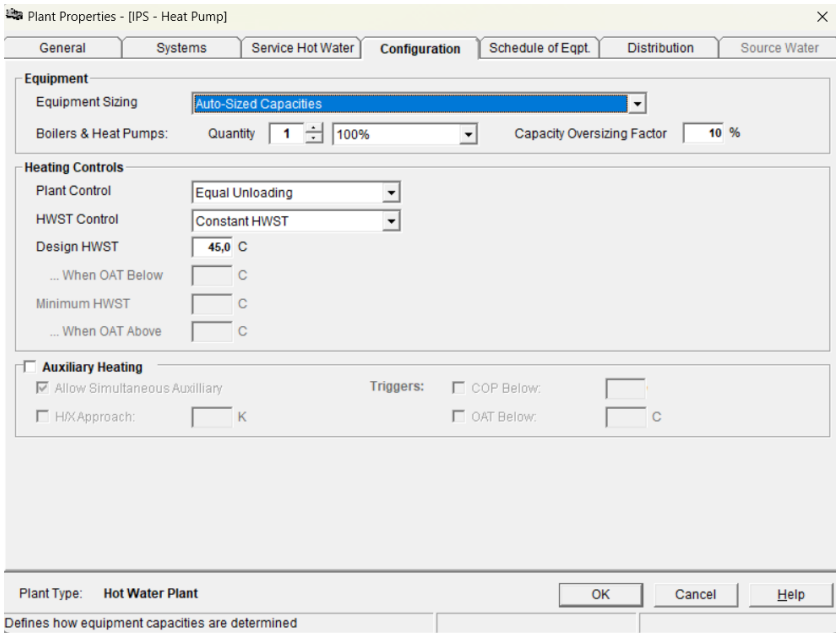


Figura 9-13 - *HAP Plant Bomba de Calor – Configuration*

9.4.9 Schedule of Equipment

Neste separador foram seleccionados os equipamentos que servem esta central, Figura 9-14.

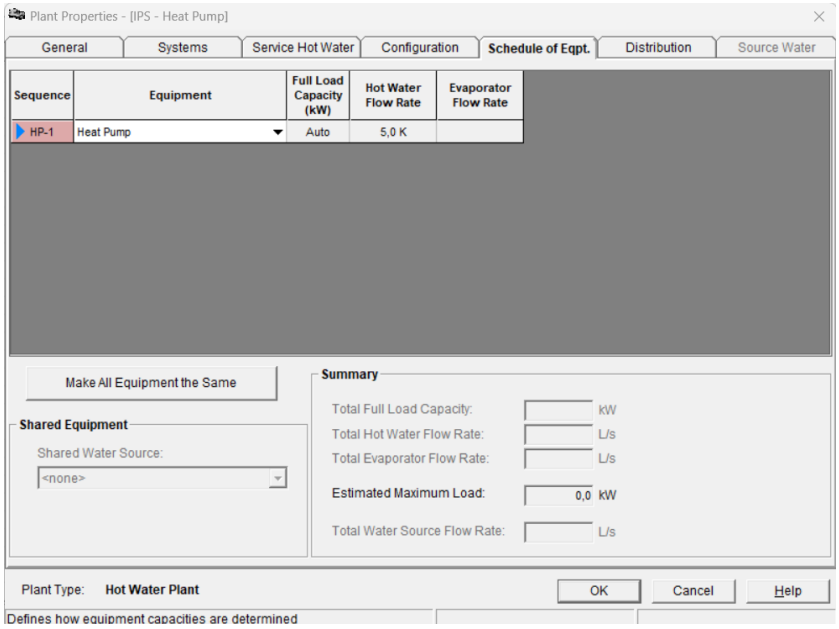


Figura 9-14 - *HAP Plant Bomba de Calor – Schedule of Equipment*

9.4.10 Distribution

Neste separador foi seleccionada e configurada a bomba de circulação de água da central, Figura 9-15.

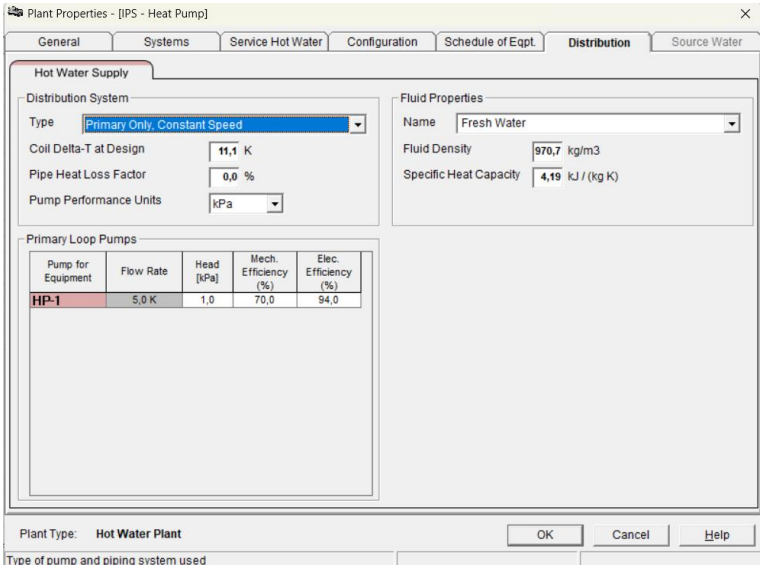


Figura 9-15 - *HAP Plant Bomba de Calor – Distribution*

9.5 Equipamentos (*Chiller Properties*)

9.5.1 Chiller

Para a criação do *Chiller* no HAP usa-se o menu "*Chiller / <New Default Chiller>*". Criou-se um novo *Chiller* que produz água fria para as UTAN/FAHU e os Ventilo Convectores. Figura 9-16

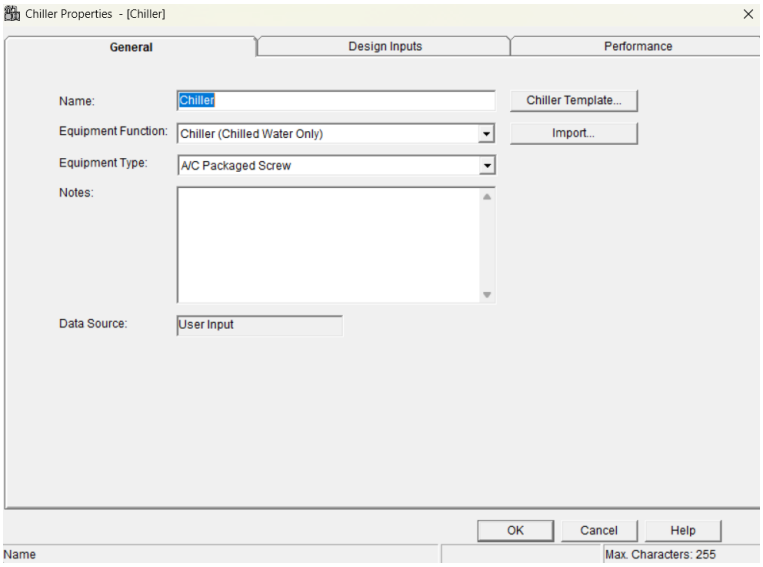


Figura 9-16 - *HAP Chiller – Genera*

9.5.2 Design Inputs

Neste separador foram configuradas as temperaturas da água, a temperatura exterior e as características do *Chiller*, Figura 9-17.

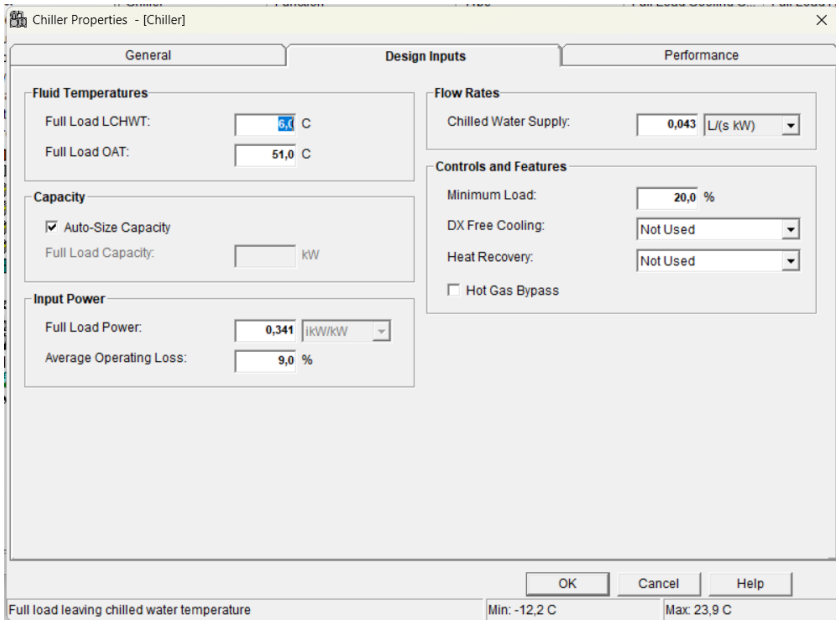


Figura 9-17 - *HAP Chiller – Design Inputs*

9.5.3 Performance

Neste separador foram configuradas as eficiências do *Chiller*. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do clima do projecto, Figura 9-18.

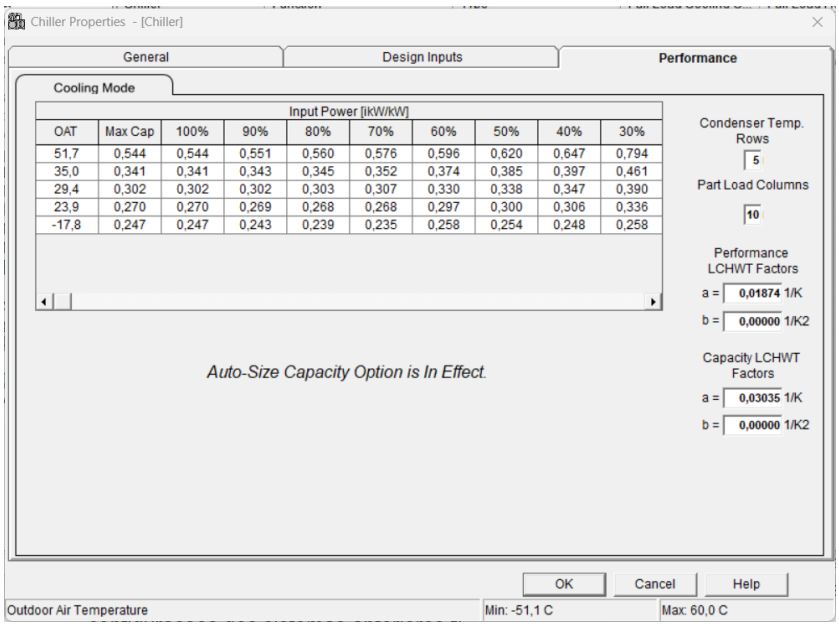


Figura 9-18 - *HAP Chiller – Performance*

9.5.4 Bomba de Calor

Para a criação da Bomba de Calor no HAP usa-se o menu "*Chiller / <New Default Chiller>*". Criou-se uma nova Bomba de Calor que produz água quente para as UTAN/FAHU e todos os Ventilo Convectores. Figura 9-19

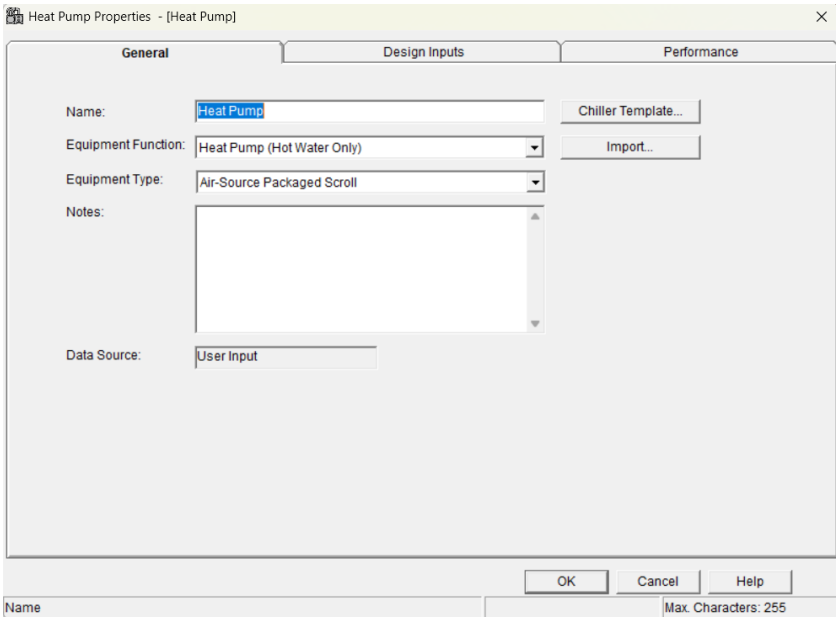


Figura 9-19 - *HAP Bomba Calor – General*

9.5.5 Design Inputs

Neste separador foram configuradas as temperaturas da água, a temperatura exterior e as características da Bomba de Calor, Figura 9-20.

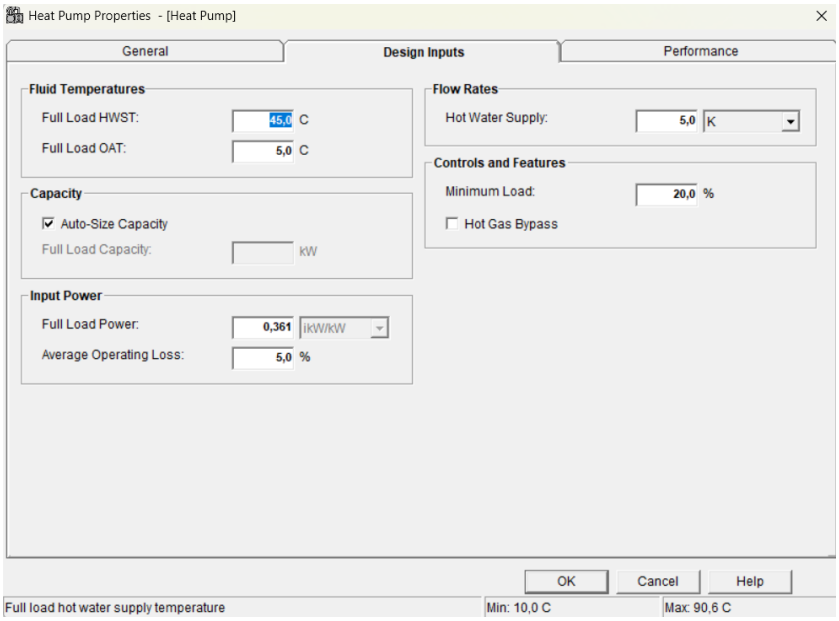


Figura 9-20 - *HAP Bomba de Calor – Design Inputs*

9.5.6 Performance

Neste separador foram configuradas as eficiências da Bomba de Calor. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do clima do projecto, Figura 9-21

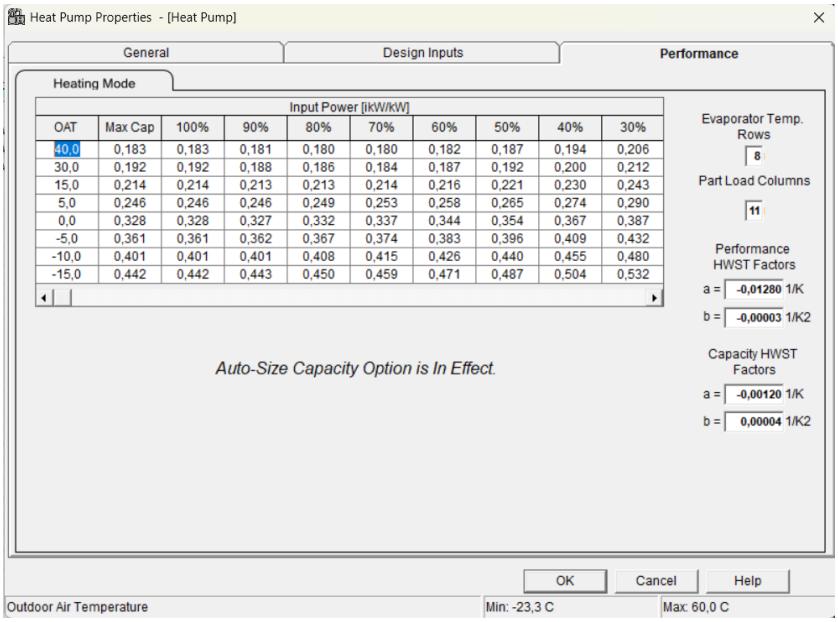


Figura 9-21 - *HAP Bomba de Calor – Performance*

9.6 *Alternatives*

9.6.1 General

Foi definida uma nova alternativa para o novo sistema, Figura 9-22.

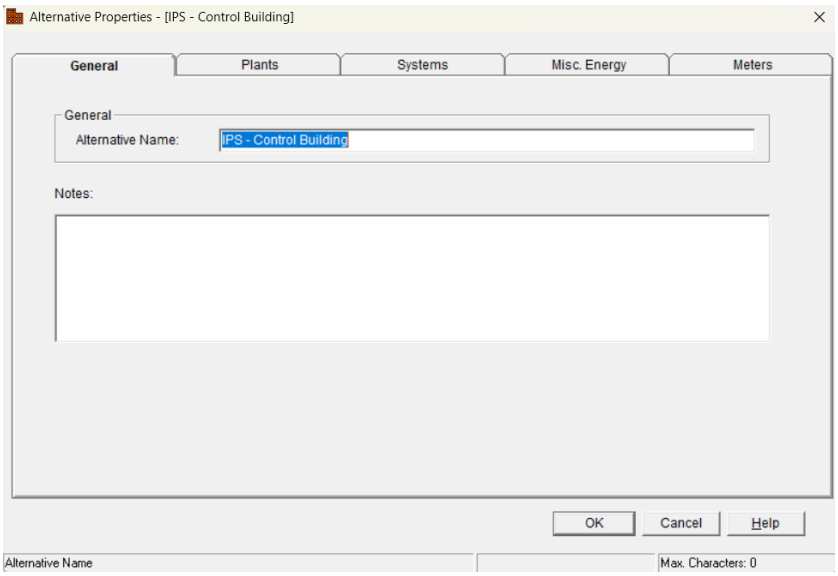


Figura 9-22 - *HAP Alternatives Properties – General*

9.6.2 Plants

Foram seleccionadas as centrais que fazem parte do edifício em estudo, Figura 9-23.

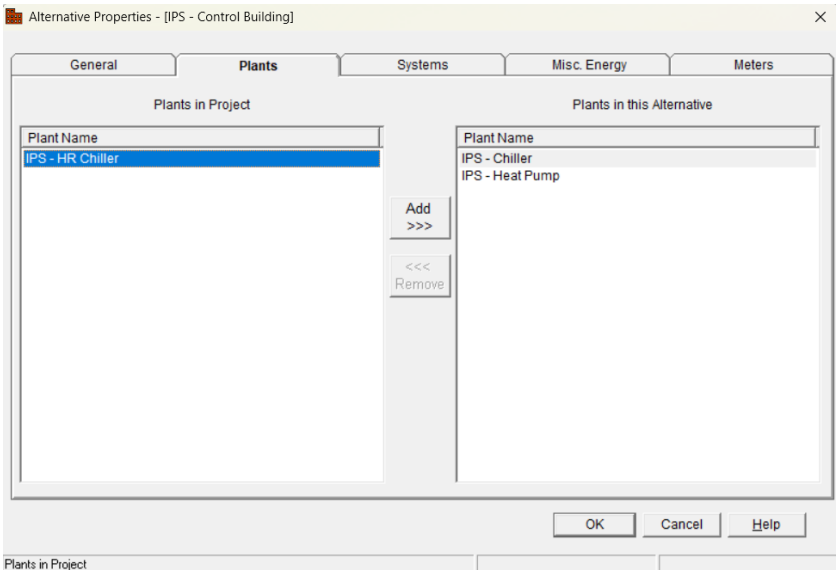


Figura 9-23 - *HAP Alternatives Properties – Plants*

9.6.3 Systems

Os sistemas foram adicionados automaticamente, neste caso são os sistemas que estão associados à central seleccionada anteriormente, Figura 9-24.

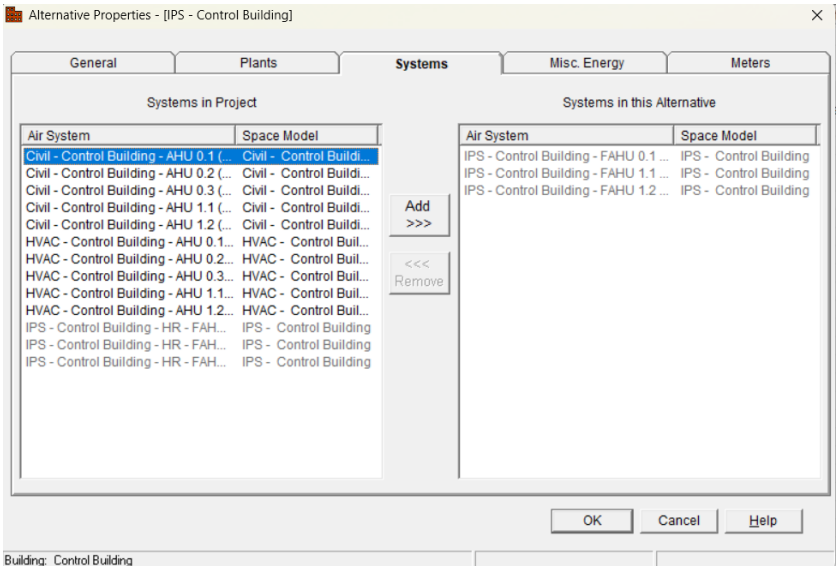


Figura 9-24 - *HAP Alternatives Properties – Systems*

9.6.4 *Misc. Energy*

No caso do novo sistema consideraram-se apenas os ventiladores de extracção dos espaços, Figura 9-25

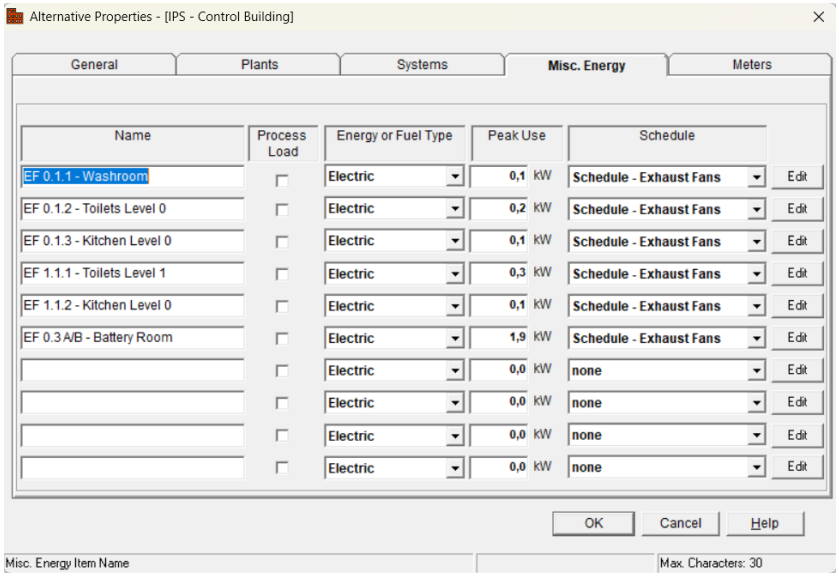


Figura 9-25 - *HAP Alternatives Properties – Misc. Energy*

Os perfis de utilização para os ventiladores não foram alterados.

9.6.5 *Meters*

Também se mantiveram todas as configurações dos sistemas anteriores para as tarifas.

9.7 Cálculo de Cargas (*Design Load Report*)

No separador *Alternatives* seleccionou-se "*Print/View Design Load*" que abre o menu "*Design Load Report Options*" onde se seleccionaram os relatórios desejados, Figura 9-26.

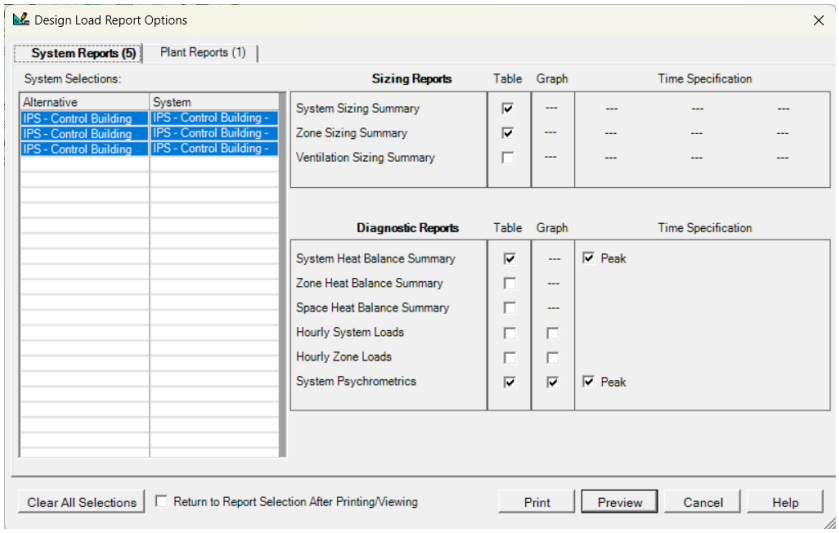


Figura 9-26 - *HAP Design Load Report Options- System Reports*

Para cada sistema do edifício obteve-se os vários relatórios com as cargas dos espaços, as potências e caudais das UTAN/FAHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi mais uma vez compilada no documento *Room Criteria List* (Anexo V) que permitiu redimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.). Esta informação foi ainda usada para completar o novo PFD-Alternativa *Chiller* e Bomba de Calor (Anexo VI)

9.8 Simulações (*Energy Modeling Report*)

Nesta fase, todos os dados relativos ao edifício e seus sistemas foram introduzidos no HAP. O cálculo de energia pode ser feito a vários níveis: do edifício, da central ou dos sistemas. No caso dos sistemas usados neste projecto, usam-se os resultados no nível Central.

No separador *Alternatives* seleccionou-se "*Print/View Energy Modeling Results*" que abre o menu "*Energy Modeling Report Options*", onde se seleccionaram os relatórios desejados, Figura 9-27.

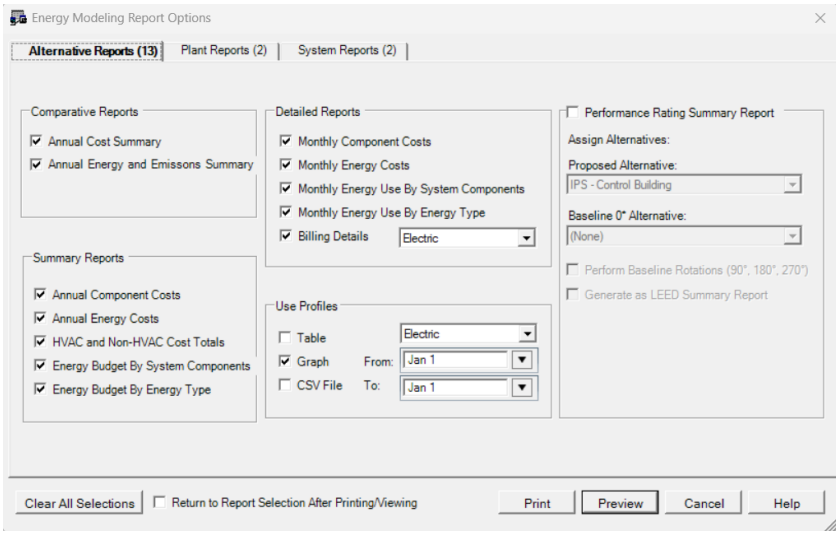


Figura 9-27 - *HAP Energy Modeling Report Options- Alternative Reports*

10 Alternativa dos sistemas de AVAC – *Chiller* com recuperação

Nesta variante da alternativa anterior apenas se alterou o tipo de central do edifício, ou seja, substituiu-se a combinação *Chiller* e Bomba de Calor por um *Chiller* com recuperação, com o objectivo de usar o calor retirado das salas técnicas, durante o Inverno, para aquecer o ar novo e os espaços que necessitem de aquecimento.

10.1 Centrais Térmicas (*Plants*)

Para a criação das centrais térmicas no HAP usou-se o menu “Plants / <New Default Plant>”. Criou-se uma nova central térmica, composta por um *Chiller* com recuperação de calor que produz água fria e água quente para as UTAN/FAHU e para os Ventilo Convectores. Adicionalmente foi necessário criar uma caldeira para apoio ao aquecimento.

10.1.1 Plant – Heat Recovery Plant

Esta central é composta por uma *Heat Recovery Plant*, Figura 10-1

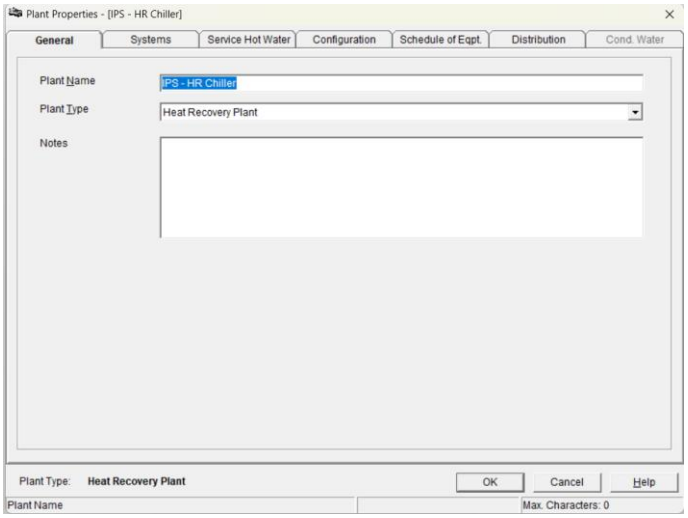


Figura 10-1 - *HAP Plant Chiller – General*

10.1.2 Systems

Foram seleccionados os sistemas que são servidos pela central, Figura 10-2.

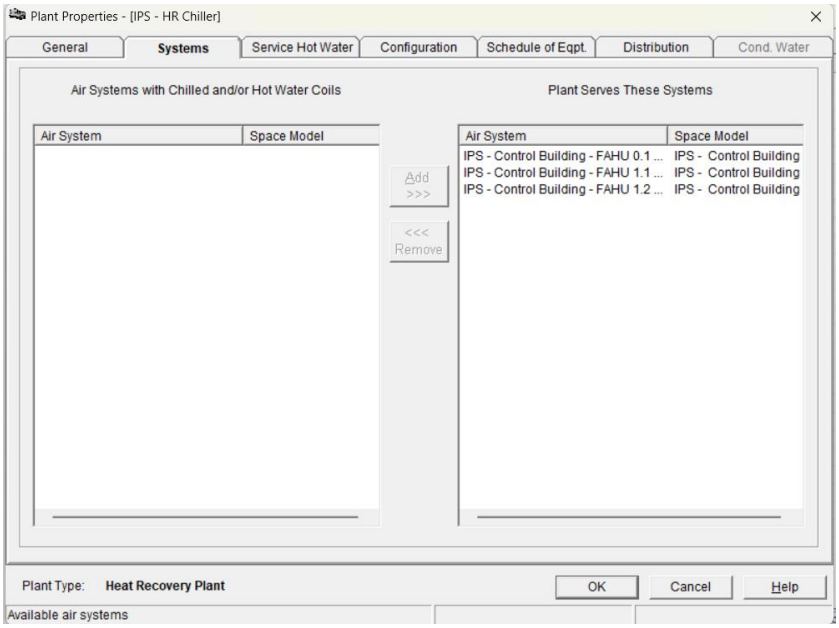


Figura 10-2 - *HAP Plant Chiller – Systems*

10.1.3 Configuration

Neste separador foram configurados os factores de segurança, as temperaturas da água do *Chiller* e o tipo de recuperação de calor, Figura 10-3.

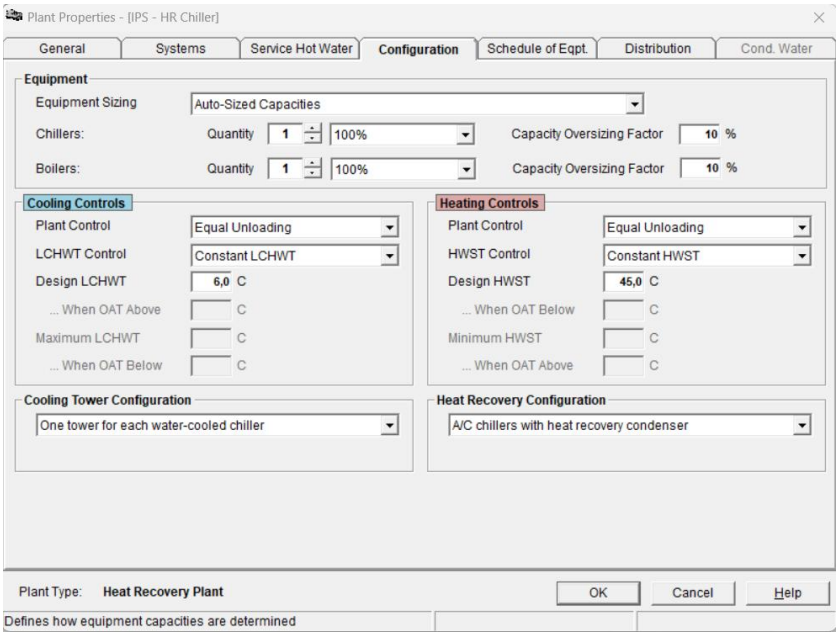


Figura 10-3 - *HAP Plant Chiller – Configuration*

10.1.4 Schedule of Equipment

Neste separador foram seleccionados os equipamentos que servem esta central, Figura 10-4.

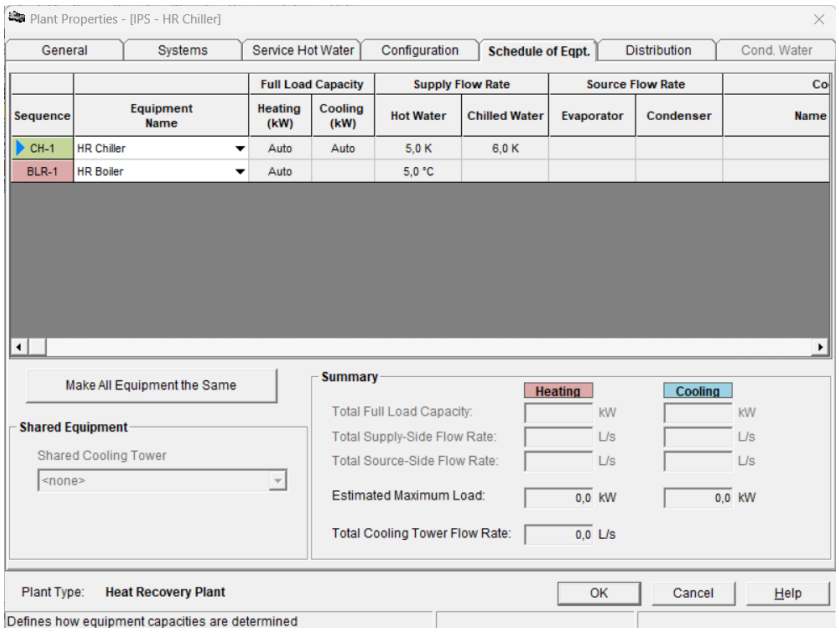


Figura 10-4 - *HAP Plant Chiller – Schedule of Equipment*

10.1.5 Distribution

Neste separador foram seleccionadas e configuradas as bombas de circulação de água da central, Figura 10-5.

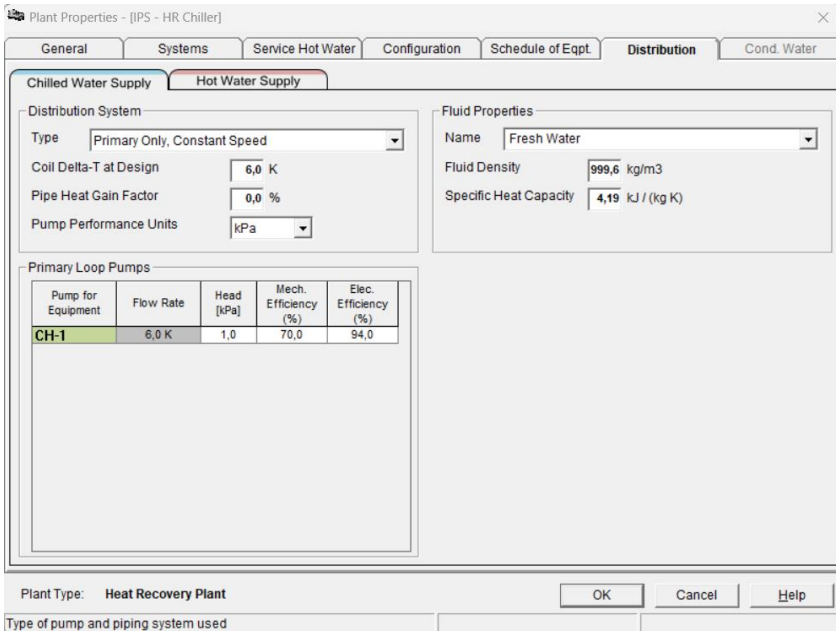


Figura 10-5 - *HAP Plant Chiller – Distribution*

10.2 Equipamentos (*Chiller Properties*)

10.2.1 Chiller com recuperação de calor

Para a criação do *Chiller* no HAP usa-se o menu "*Chiller / <New Default Chiller>*". Criou-se um novo *Chiller* que produz água fria e quente para as UTAN/FAHU e os Ventilo Convectores. Figura 10-6

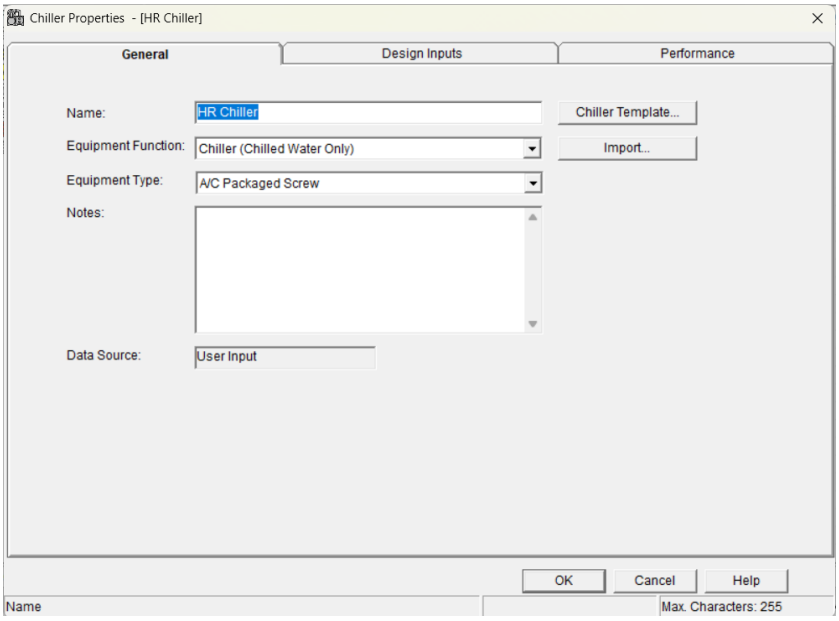


Figura 10-6 - *HAP Chiller – General*

10.2.2 Design Inputs

Neste separador foram configuradas as temperaturas da água, a temperatura exterior e as características do *Chiller*, Figura 10-7.

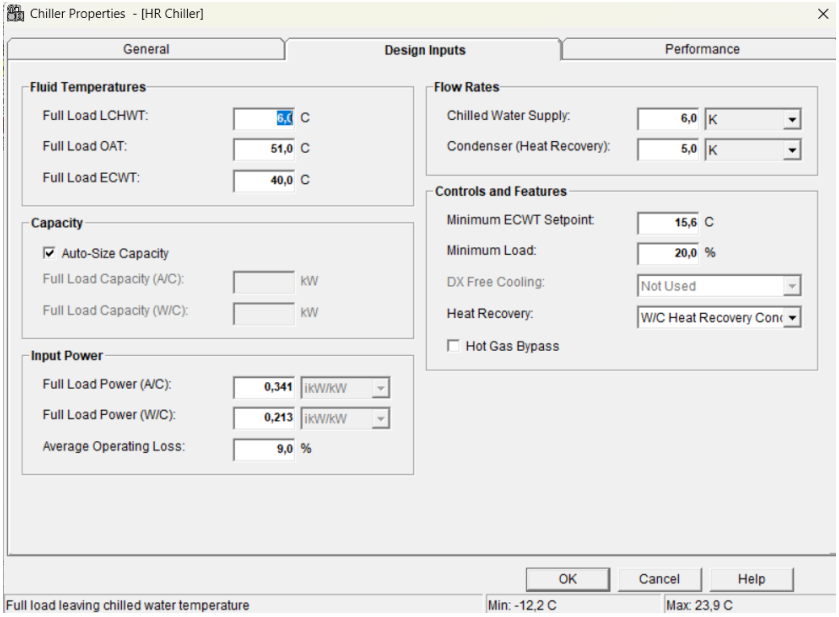


Figura 10-7 - *HAP Chiller – Design Inputs*

10.2.3 Performance

Neste separador foram configuradas as eficiências do *Chiller*. Optou-se por usar os valores por defeito do programa que são automaticamente ajustados às temperaturas exteriores do clima do projecto, Figura 10-8.

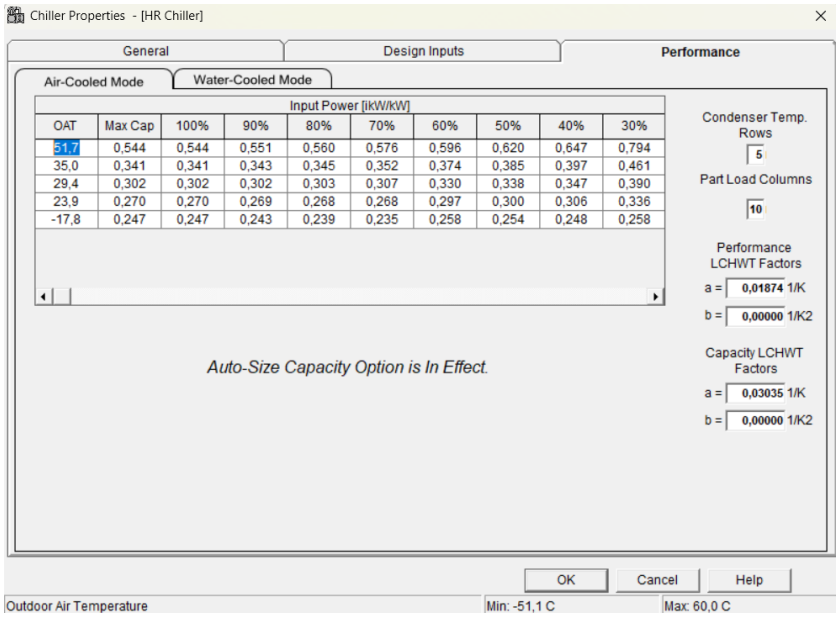


Figura 10-8 - *HAP Chiller – Performance*

10.2.4 Boiler

Para a criação da Caldeira usa-se o menu "Boilers / *<New Default Boiler>*". Criou-se uma nova Caldeira eléctrica para apoio ao *Chiller* que produz água quente para as UTAN/FAHU e para os Ventilo Convectores, quando o *Chiller* não tiver capacidade suficiente. Neste separador foram configurados o tipo de caldeira, as temperaturas da água e as características da Caldeira. Figura 10-9.

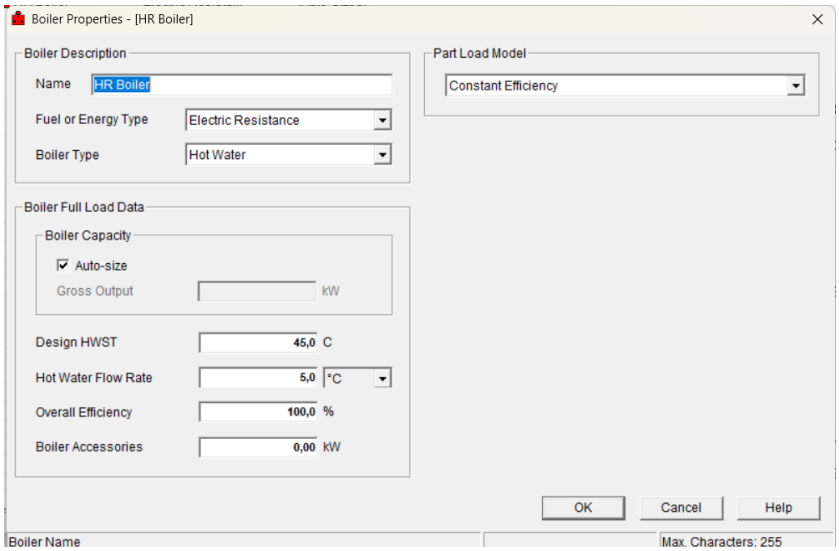


Figura 10-9 - *HAP Boiler Properties*

10.3 *Alternatives*

10.3.1 General

Foi definida uma nova alternativa para o novo sistema, Figura 10-10.

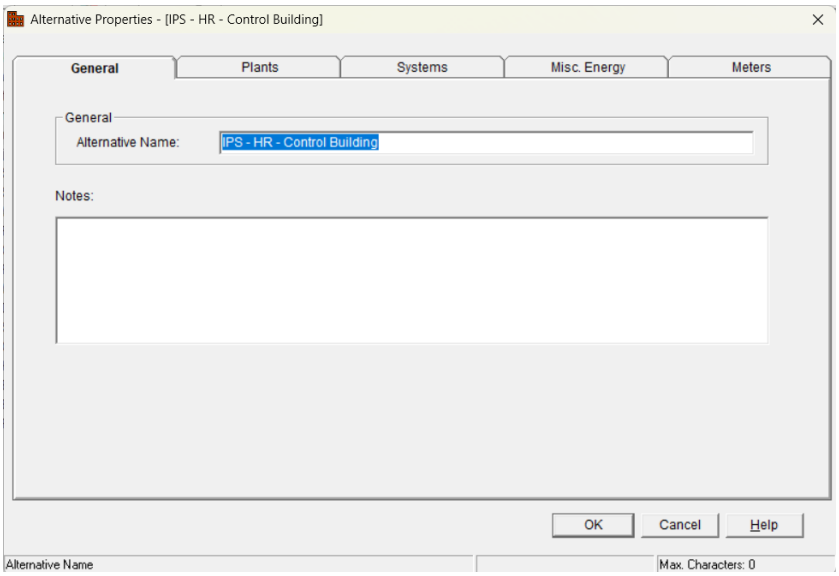


Figura 10-10 - *HAP Alternatives Properties – General*

10.3.2 Plants

Foram seleccionadas as centrais que fazem parte do edifício em estudo, Figura 10-11.

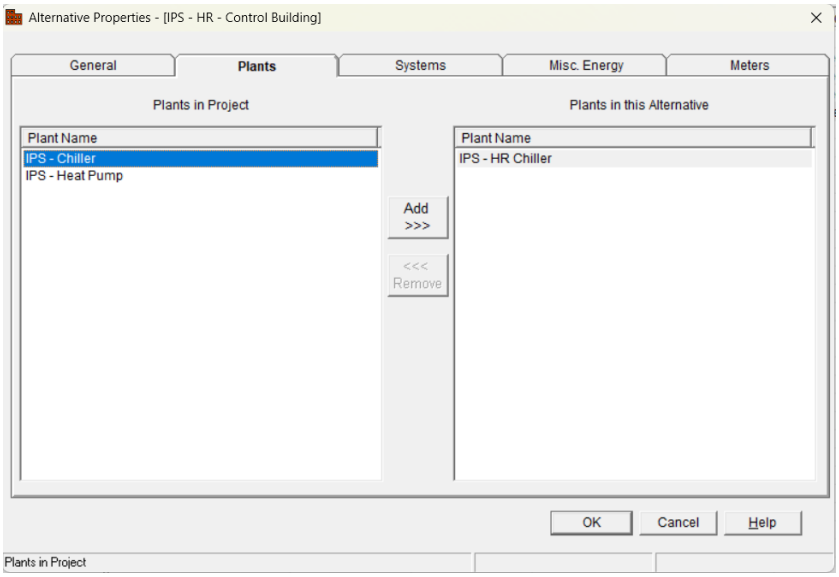


Figura 10-11 - *HAP Alternatives Properties – Plants*

10.3.3 Systems

Os sistemas foram adicionados automaticamente, neste caso são os sistemas que estão associados à central seleccionada anteriormente, Figura 10-12

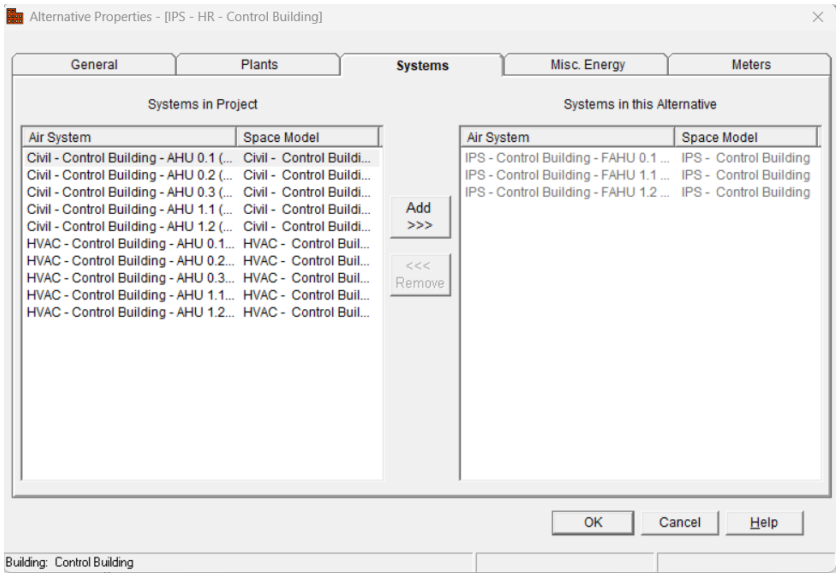


Figura 10-12 - *HAP Alternatives Properties – Systems*

10.3.4 Misc. Energy

No caso do novo sistema consideraram-se apenas os ventiladores de extracção dos espaços, Figura 10-13

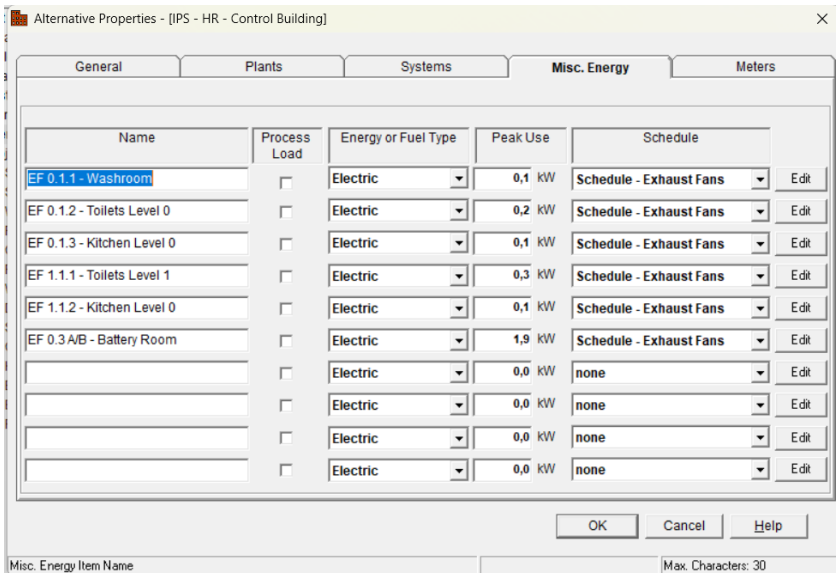


Figura 10-13 - *HAP Alternatives Properties – Misc. Energy*

Os perfis de utilização para os ventiladores não foram alterados.

10.3.5 Meters

Também se mantiveram todas as configurações dos sistemas anteriores para as tarifas.

10.4 Cálculo de Cargas (*Design Load Report*)

No separador *Alternatives* seleccionou-se "*Print/View Design Load*" que abre o menu "*Design Load Report Options*" onde se seleccionaram os relatórios desejados, Figura 10-14.

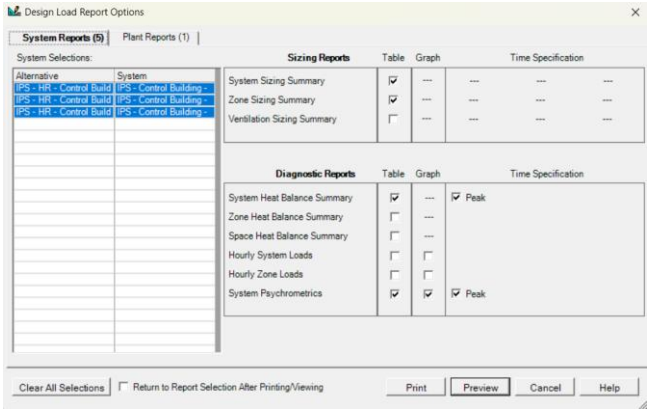


Figura 10-14 - *HAP Design Load Report Options- System Reports*

Para cada sistema do edifício obteve-se os vários relatórios com as cargas dos espaços, as potências e caudais das UTAN/FAHU, as potências e caudais dos espaços, bem como os relatórios psicrométricos.

Esta informação foi mais uma vez compilada no documento *Room Criteria List* (Anexo V) que permitiu redimensionar as várias unidades usadas para ventilar e climatizar o edifício (UTA/AHU, baterias de reaquecimento, ventiladores, etc.).

10.5 Simulações (*Energy Modeling Report*)

Nesta fase, todos os dados relativos ao edifício e seus sistemas foram introduzidos no HAP. O cálculo de energia pode ser feito a vários níveis: do edifício, da central ou dos sistemas. No caso dos sistemas usados neste projecto, usam-se os resultados no nível Central.

No separador *Alternatives* seleccionou-se "*Print/View Energy Modeling Results*" que abre o menu "*Energy Modeling Report Options*", onde se seleccionaram os relatórios desejados, Figura 10-15.

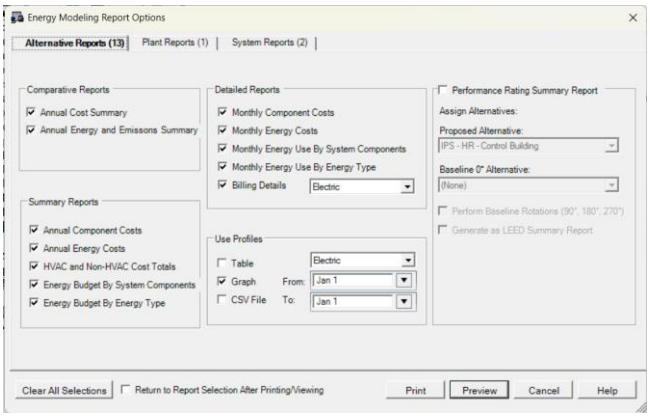


Figura 10-15 - *HAP Energy Modeling Report Options- Alternative Reports*

Anexo II

Design Criteria

Documento criado durante o projecto original com base nas normas locais e do cliente. Serviu de base para o desenvolvimento do projecto durante a fase "*Basic Engineering*", alternativas Civil e HVAC. Por motivos de confidencialidade, este documento foi editado para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

DESIGN CRITERIA

CONFIDENTIAL – NOT TO DISCLOSE WITHOUT AUTHORIZATION

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1 Introduction

1.1 Project Description

1.2 Document Objective

The objective of this document is to provide the minimum HVAC design requirements as well as general guidelines for HVAC systems design for Project XXXX. HVAC systems shall provide safe indoor working environment by means of ventilation, air conditioning, air filtration and space pressurization thus maintaining required thermal conform and acceptable air quality.

This document describes the design criteria to be utilized for the design, calculations, sizing and selection of the equipment, controls, testing, operation, and maintenance of the HVAC systems.

The HVAC Design Criteria document shall apply to the two water injection facilities.

This document covers the minimum requirements for design. While this document provides general guidance, it shall not be a substitute for good engineering judgment which should be applied as appropriate with the approval of the respective Lead Engineer.

Any conflicts between applicable “Client” Engineering Standards & Specification, Industry Codes & Standards, etc., shall be brought to the attention of Company Representative by the Supplier for resolution.

In the event of an inconsistency, conflict, or discrepancy within any applicable of the Codes, Standards, Specifications and Statutory requirements, the most stringent and safest requirement applicable to the project shall prevail.

The COMPANY shall formally approve this document before design is commenced.

1.3 Scope

1.4 Units

In general, the SI system of metric units shall be used on the Project. If some original data are presented in Imperial units, they have to be accompanied in the parenthesis by their SI equivalent.

1.5 Language

All Project documentation shall be in English language.

1.6 Project Data

1.6.1 Design Data

- Altitude: Sea Level (+ 132 meter Approx.)
- Latitude: XX° North
- Longitude: XX° East

1.6.2 Project Location

2 Definitions and Abbreviations

2.1 Definitions

2.2 Abbreviations

3 Applicable Specifications, Codes and Standards

3.1 General

The design of HVAC systems shall comply with the latest editions of the following National statutory requirements, "Client" standards, specifications, and drawings as well as international standards and codes. The documentation listed below shall not be treated as exhaustive, other additional standards as appropriate shall be considered applicable.

In the event of conflict between codes and standards the specified below order of precedence shall be followed although any conflicts shall be brought to COMPANY's attention with recommendations for resolution and COMPANY decision shall be binding with no commercial impact

Where national "Middle East Country" regulations, codes and standards exist, their recommendations shall always apply. Such national regulations shall therefore supplement or amend the provisions of this document.

3.2 Order of Precedence

3.3 "Middle East Country" Regulations

3.4 Project Specifications and "Client" Standards

3.5 International Standards

Table 1 - International Standards and Descriptions.

Document No.	Description
ASHRAE 62.1	Ventilation for Acceptable Indoor Air Quality
ASHRAE 15	Safety Standard for Refrigeration System
ASHRAE 52.2	Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size
ASHRAE 55	Thermal Environmental Condition for Human Occupancy
ASHRAE 111	Practice for Measurement, Testing, Adjusting and Balancing, Air-Conditioning, and Refrigeration System

Document No.	Description
ASHRAE 34	Designation and Safety Classification of Refrigerants
ASHRAE 90.1	Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings
ASHRAE 147	Reducing the Release of Halogenated Refrigerants
ASHRAE 189.1	Standard for the Design of High-Performance Green Buildings
ASHRAE Handbooks	ASHRAE Fundamentals, ASHRAE Refrigeration, ASHRAE HVAC Applications, ASHRAE HVAC Systems and Equipment
ASME 31.5	Refrigeration Piping
ASME 31.9	Building Services Piping
ASTM A53	Standard Specification Pipe, Steel, black and hot-dipped, zinc coated, welded and seamless
ASTM A90	Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A653	General requirements for Zinc coated galvanized steel Sheets.
ASTM B88	Copper Pipe for Refrigerants
ASTM B280	Standard specification for seamless copper tube for air conditioning and refrigeration field service
ATEX	Equipment and Protective systems intended to use in Potentially Explosive Atmospheres (ATEX) Directive 2014/34/EU
BESA DW 143	Ductwork Leakage Testing
BESA DW 144	Specification for Sheet Metal Ductwork
BESA DW 145	Guide to Good Practice for the Installation of Fire and Smoke dampers
BESA DW 154	Specification for Plastics Ductworks
BS 1723 Part 1	Specification for Brazing
BS 1845	Filler Metals for Brazing
BS 4999	Rotating Electrical Machines
BS 5422	Thermal Insulating Materials on Pies Ductwork and Equipment

Document No.	Description
BS EN 806	Specifications for installations inside buildings conveying water for human. consumption
BS EN 1452.2	Plastic Piping Systems for water supply (PVC-U)
BS EN 1751	Ventilation for Buildings. Air Terminal Devices. Aerodynamic Testing of Dampers and Valves
BS EN 8558	Water Use in Domestic Buildings
BS EN 10143	Continuously hot dip coated steel sheet and strip. Tolerances on dimensions and shape
BS EN 10346	Continuously hot dip coated steel flat products. Technical delivery conditions
BS EN 12056	Gravity drainage systems inside buildings.
BS EN 60335-2-21	Household and similar electrical appliances. Safety. Particular requirements for storage water heaters
BS EN 60335-2-35	Specification for safety of household and similar electrical appliances
BS EN ISO 16890	Air filters for general ventilation. Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM), superseded BS EN 779 (Particulate Air Filters for General Ventilation)
IBC	International Building Code
ICC	International Conservation Code
IEC 60034	Rotating Electrical Machines
IEC 60079	Electrical Apparatus for Explosive Gas Atmosphere
IP Part 15	Area Classification Codes for Installation Handling Flammable Fluids
IPC	International Plumbing Code
ISA 71.04	Environmental Conditions for Process Measurement and Control System: Airborne Containments
NFPA 1	National Fire Prevention Code
NFPA 90A	Standard for The Installation of Air- Conditioning and Ventilating System
NFPA 101	Life Safety Code
NFPA 220	Standard on Types of Building Construction
NFPA 496	Standard for Purged and Pressurised Enclosures for Electrical Equipment's

4 HVAC Design Conditions and Parameters

4.1 Project Standard

The design life for the Project facilities shall be 25 years. The equipment and systems shall be suitable for continuous operation at a desert location under extreme ambient temperatures and humidity levels. The atmosphere is generally dusty and corrosive.

4.2 Ambient Design Conditions

4.2.1 Temperature and Humidity

XXXXX are positioned more than 2,5 km away from the Gulf coast and therefore their location is classified as 'interior' as per "Client" Standards and "Middle East Regulation" regulations.

All buildings within the Project scope are located within the "Client" Facilities therefore they are classified as Plant Buildings as defined in XXX.

The HVAC systems shall be designed based on following criteria generally based on the most demanding conditions specified in "Middle East Regulation", "Middle East Regulation", XXX and XXX:

- Summer: 51,7 ºC / 28,9 ºC DB/WB temperature, daily range 13,3ºC (as per XXX). Air-cooled equipment shall stay operational without tripping up to 52,0 ºC (DB) as stipulated in "Middle East Regulation".

- Winter: 4,5 ºC / 2,0 ºC DB/WB temperature, daily range 13,3 ºC (per "Middle East Regulation" and XXX).

The HVAC & Mechanical equipment, pipes, ducts, controls, and instruments, etc. located outside shall be rated for following design conditions as stipulated in XXX and XXX:

- Summer: 55,0 ºC DB temperature (shade), 93,0 ºC DB temperature (exposed to solar radiation and not protected by coating/lining), exposed metal black body maximum temperature is 85,0 ºC DB.

- Winter: 3,5 ºC DB temperature (shade).

For dry bulb and wet bulb temperatures for all DX (Direct Expansion) Air Conditioning units refer to "Client" Standard for HVAC System and Equipment: Direct Expansion (DX) Type" XXX.

48 °C dry bulb / 25,5°C wet bulb temperature for the interior areas (beyond 2,5 km from the coast) during summer for all Chilled Water Air Conditioning units.

4,5 °C dry bulb / 2,0 °C wet bulb temperature for the coastal and interior areas of "Middle East Country" (coastal is within 2,5 km and interior is beyond 2,5 km from the coast) during winter for all Chilled Water Air Conditioning units.

4.2.2 Sandstorms

"Middle East Country" is subject to sandstorms, particularly during the summer months. For detailed data on dust concentration and dust particle size please refer to XXX.

4.2.3 Wind

Prevailing wind direction is NNW in the summer and NW in winter. For detailed data on wind speeds please refer to XXX.

4.3 Indoor Design Conditions

HVAC Systems sizing shall be in accordance with the indoor selection criteria provided below, as specified in XXX:

Table 2 - Indoor Design Conditions for specific applications.

Space/Zone	Summer	Winter	% RH	Noise Criteria [NC]	Remarks
Auditorium	(75±2) °F / (24±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	20 ~ 25	Cooling & Heating both
Control Room, Offices, UPS Room, Training Room, Security Post Building	(75±2) °F / (24±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	30 ~ 35	Cooling & Heating both
Library, Mosque	(75±2) °F / (24±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	25 ~ 30	Cooling & Heating both
Dining Rooms, Cafeteria, Pantry	(75±2) °F / (24±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	40 ~ 45	Cooling & Heating both
Storerooms, Janitor Room, Locker Room	(78±2) °F / (25.6±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	40 ~ 45	Cooling & Heating both
Toilet, Corridors	(78±2) °F / (25.6±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	30 ~ 35	Cooling & Heating both. RH not controlled for Toilet
Laboratories	(75±2) °F / (24±1) °C	(70±2) °F / (21±1) °C	55 (±5%)	30 ~ 35	Cooling & Heating both
AHU Room, Switchgear Room, Control Panel Room, Battery Room, Gas Cylinder Room	(78±2) °F / (25.6±1) °C	-	55 (±5%)	30 ~ 35	Cooling only
Telecom Room (5)/ Communication Room	(72±2) °F / (22.2±1) °C	-	55 (±5 %)	30 ~ 35	Cooling only

Note 1: Sound level of spaces (Noise Criteria [NC]) shall be maintained at levels not exceeding those listed above by utilizing acoustical devices. Noise level inside the conditioned spaces, resulting from HVAC System, shall be measured by an approved sound level meter at 1 meter distance from air outlet.

Note 2: Workshop, Utility and Generator Building shall be provided with Mechanical Ventilation only unless otherwise specified in the project document.

Note 3: ASHRAE Fundamental Handbook shall be referred for the indoor design conditions of Space / Zone which are not listed under Table-1 of this Standard.

Note 5: To be designed according to XXX standard.

4.4 Operating Requirements

The HVAC systems shall be designed for continuous operation while some systems or parts of systems may be operating on intermittent basis. HVAC main control panel (HCP) shall be positioned internally in the controlled environment. HVAC Equipment located externally shall be designed for the ambient conditions and all associated hazards.

4.5 HVAC Calculations

HVAC load calculations shall be performed as stipulated in the “Middle East Regulation”. The latest version of Carrier E20-II HAP (Hourly Analysis Program) software.

Design margins shall be applied in general accordance with the ASHRAE guides. Typical examples are given below:

Table 3 - Margin for Heat Loads Calculations.

Item	Margin (%)
Cooling load (sensible)	10
Cooling Load (latent)	10
Heating Load	10

Cooling Coil bypass factor shall be taken as 0,1. Chilled Water-Cooling Coils shall follow the margins stipulated in “Middle East Regulation” regarding inlet temperature and pressure drop.

As per doc. “Middle East Regulation” Rating for chilled water systems is based on the following parameters:

- Water temperature at the chiller outlet is 6,67 °C (44 °F).
- Temperature drop of chilled water across the evaporator is 5,56 °C (10 °F). However, higher temperature differential may be used for loads exceeding 500 RT to reduce pumping power while maintaining the above maximum kW/RT system rating.
- Temperature drop of cooling water across the condenser is 5,56 °C (10 °F).
- Fouling factors for the evaporator and condenser are 0,000044 m².°C/W (0,00025 ft².h.°F/Btu) and 0,000132 m².°C/W (0,00075 ft².h. °F)/Btu), respectively.
- Water pressure drop in the evaporator and condenser of chiller and AHU coil is 4,6 m (15 ft)

All final equipment selection shall be tabulated in HVAC Equipment Schedules.

4.6 Building Envelop

For U-values (thermal transmittance) refer to “Middle East Regulation” which is the governing regulation in that design aspect (i.e., buildings with different construction types, fenestration, etc.). For further details about building envelop, refer to XXX.

The building envelope was considered as follows:

- Exterior walls: 0,568 W/m²·K
  - Columns: 0,568 W/m²·K
  - Beams: 0,398 W/m²·K
- Roof: 0,398 W/m²·K
- Floor: 0,568 W/m²·K
- Windows (1):
  - Transmission: 3,61 W/m²·K
  - Shading: 40%
- Doors: 2,0 W/m²·K

(1) Windows to Wall ration <10%

The Building Envelope Components (Exterior Walls, Roofs, and Floors) of unconditioned spaces connected to conditioned spaces shall have U-values similar to the conditioned spaces.

Floors exposed to ambient conditions shall have U-values similar to roofs and partitions exposed to unconditioned areas shall have U-values similar to walls.

A detailed study of the building envelope shall be done in the next project phase.

4.7 Heat Gains & Losses

All applicable heat gains shall be taken into account when calculating the cooling load, i.e., fabric gains (including solar radiation), equipment, lighting, and personnel.

For the calculation of heat losses, no simultaneous heat gains shall be included. Bosensible and latent heat transfer shall be taken into account where applicable.

The necessary values shall be obtained from Project referred documentation. For detail design the equipment data (including lighting) shall be based on vendor/manufacturer provided information.

4.8 Minimum Required Energy Conservation Measures for Buildings

In order to meet the ‘Basic Energy Conservation Requirements,’ the code stipulates that certain minimum standard for energy conservation measures be adhered to.

The building designer shall consider more stringent measures to abide by the aforementioned requirements and no deviations shall be permitted.

Such measures may include, but not limited to, more insulation, shading devices, more efficient A/C system, more efficient lighting systems, more efficient glazing for windows, and better controls leading to a Building Automation System (BAS). Refer to “Middle East Regulation” for further details.

5 HVAC Design Requirements

5.1 General

HVAC design process shall provide safe, reliable, maintainable, energy efficient and user-friendly HVAC systems assuring optimal operating environments for people and equipment.

The non-compliance to the current relevant standards and codes shall be identified for further review and approval by COMPANY. The design philosophy shall be developed in line with the current applicable codes and standards. Refer to “Middle East Regulation” for further details.

5.2 Ventilation Rates

a) The fresh air requirement and Indoor Air Quality (IAQ) shall be determined generally in accordance with ASHRAE standard 62.1 or the required make up air for exhaust systems, whichever is greater. All buildings (Plant & Non- Plant) shall have 0,5 Air Change Per Hour (ACPH) minimum pressurisation unless otherwise specified. For further details refer to XXX.

b) Table-6 of this Standard presents the outdoor air requirements for ventilation of common applications as a general guidance.

Table 4 - Outdoor Air Requirements for Ventilation of common applications as a general guidance.

Application	Outdoor Air Requitements*			Remarks
	Occupancy Based [L/(s·p)] [(m³/(h·p)]	Area Based [L/(s·m²)] / [(m³/(h·m²)]	ACH Based	
Offices, Conference Room, Laboratory, Dining	10 / 36			Supply & Exhaust
Reception, Lobby, Library	7,5 / 27			Supply & Exhaust
Clinic Room	12,5 / 45			Supply & Exhaust
Ball / Game Room	15 / 54			Supply & Exhaust
Store, Gas Cylinder & Generator Room			4	Supply & Exhaust
Pantry			8	Supply & Exhaust
Toilets		1 / 3,6	12	Supply & Exhaust
Battery Room			12	Supply & Exhaust
* Higher values among occupancy based, area based or ACPH shall be considered for fresh air requirements.				

c) Outdoor air requirements (occupancy & area based) are as per ASHRAE Standard 62.1-2016. All other areas / application which are not listed above or not specified in the project document / ASHRAE shall have a minimum fresh air supply 10 l/s (20 CFM) per person based on maximum occupancy.

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d) Control Building and Substation Building shall be designed to maintain a positive pressure level as 0,2" WG (5 mm WG) (50 Pa) and 0,1 IWG (2,5 mm WG) (25 Pa) respectively unless otherwise specified.

e) The ventilation system for Generator Room shall have intake sand trap motorised louvers and fixed blade exhaust louvers. The intake louvers shall be sized for generator combustion and ventilation requirement as per Manufacturer's instruction. Generator radiator exhaust shall be connected through duct to the exhaust louvers.

f) The exhaust from Kitchen area shall be through compensation type kitchen hood and the volume of air exhausted through the hood shall be based on the higher value of item-(i) or item-(ii) below:

   I. As per ASHRAE, Chapter Kitchen Ventilation.

   II. Total Supply CFM Kitchen area + 15 % of total supply required to maintain negative pressure between Kitchen and Adjacent Area.

g) The following areas within buildings shall be designed to be maintained under a slight negative pressure with respect to the adjacent rooms:
   I. Toilets
   II. Washrooms
   III. Locker Rooms
   IV. Battery Rooms
   V. Pantry
   VI. Laboratory.

5.3 Air Intakes and Exhausts

Air Intakes shall be preferably located on the windward side of the prevailing wind direction and in non-hazardous area at minimum 3 meters away from space classified as hazardous.

Air Exhausts shall preferably be located on the leeward side of the prevailing wind direction.

Air Intake and Exhaust Air shall be kept at minimum distance of 5 meters.

If the minimum distance of 5 meters cannot be maintained the exhaust discharge shall be mounted higher or a vertical exhaust with rain hood shall be provided.

Any possible short circulation shall be avoided, i.e., due care shall be taken to minimize the risk of smoke/odour/fumes being entrained into the air intakes (smoking rooms, toilets, etc.).

Wind pressure effect on the air intakes & discharges shall be minimized to restrict the impact on fan performance.

The air intakes shall be equipped with smoke as well as flammable and toxic gas detectors reporting to dedicated Fire & Gas System (FGS). The design of the air inlet ducts, and location of gas detectors shall be such that gas shall not bypass the detectors (and measure the correct concentration without time delay) and unacceptable amount of gas shall not enter the facility.

Low Leakage motorized shut off dampers on Fresh Air intakes and Air Exhaust lines shall close/open on applicable smoke and/or gas signals generated by FGS.

5.4 Pressurization

All the areas comprising the facility shall be by principle protected at all times via correct pressurization regime: positively, negatively, and neutrally pressurized spaces.

The pressurization regime that shall be used in the HVAC design are presented above in the Indoor Design Conditions table.

The correct pressurization regime shall be established during commissioning by setting the relevant dampers thus providing the required flow rates for the particular space. Pressurization control shall be automatic based on fan speed control (i.e., inverter) – increasing fan speed as the filters clog up thus maintaining the flow rates and pressure regime automatically at all times.

5.4.1 Positive Pressurization

The primary purpose of the facility pressurization is to mitigate the intrusion of any potential hazardous, flammable and/or toxic gases as well as dust and other air impurities. As defined in XXX the minimum differential pressure for the Control Buildings shall be 50 Pa against the reference ambient level while for the Substation Buildings it shall be 25 Pa. Maintenance Building shall be kept at nominal over pressure against the ambient while essential rooms (i.e., Telecom Room) shall follow the enhanced requirements (minimum 25 Pa) dedicated to Substation buildings. For some applications, a separate Pressurization Unit (PRU) shall be used as required by XXX.

Mechanical pressurization fan shall be used to maintain the required pressurization above the minimum level. The pressurization fan shall be selected on the steep region of the fan performance curve. A sixty (60) seconds delay time (adjustable) shall be considered upon the loss of space pressure to avoid false alarms while the doors are being opened.

5.4.2 Negative Pressurization

Areas being negatively pressurized shall achieve so by having the exhaust air 10% higher than supply air flow rate thus making that space negatively pressurized to adjacent areas.

Areas where hazardous (toxic, flammable, explosive, etc.) gas has the potential to build up for a given period of time shall always be kept negatively pressurized at all times to avoid the transfer or migration of gas to other areas, compromising the safety of occupants and resulting in damage of the non-explosion proof rated equipment.

5.4.3 Neutral Pressurization

The ventilated space where no pressurization is being applied experiences the same supply air flow rate against extract air making that area neutrally pressurized to adjacent spaces.

5.5 Noise

The internal noise limits which shall be used in the HVAC design are presented above in the respective *Table 2 - Indoor Design Conditions for specific applications.*

The maximum value for the external HVAC equipment noise limit (sound pressure level) shall be 85 dB(A) at 1 meter distance. Outdoor air inlets and outlets shall be attenuated to a value where they do not exceed the local predicted background level by 5 dB or exceed 80 dB(A) (or national standards) at a distance of 3 meters from the outlet, whichever is more stringent.

Personnel exposure limits shall be maximum 85 dB(A) for 8 hours work schedule, and 83 dB(A) for 12 hours work schedule.

Acoustic calculations shall be carried out to determine noise levels emitted from HVAC equipment when all non-HVAC plant is not operating. Where HVAC equipment impact or compromise design noise levels attenuation shall be applied to HVAC systems/equipment to reduce the noise emitted to permissible levels.

For further details refer to XXX.

5.6 Vibration

Equipment design and selection shall minimize the generation of vibration. All vibration isolators shall be selected in accordance with ASHRAE recommendations. “Middle East Country” falls under seismic active zone. For seismic data for all plant, equipment, tanks, etc. refer to XXX.

All motive equipment shall be isolated from the structure by the use of anti-vibration mountings, with an isolation efficiency of not less than 98%. This equipment shall be connected to the rest of the system, in which they are installed, by suitable flexible connections designed to minimize the transmission of vibration.

Where equipment shall produce excessive out of balance forces, these shall be mounted on inertia blocks, with the anti-vibration mountings supporting the blocks.

5.7 Air Quality

Indoor Air Quality (IAQ) shall be based on ASHRAE Standard 62.1. The first order of priority to achieve the acceptable IAQ is to draw the outside air from non-hazardous zone and being not contaminated with harmful gases, fumes, odours (avoiding short circulation with HVAC air discharges, other vents, etc.). Cooling coils condensate pans shall be designed to prevent accumulation of water, condensate traps shall be sized sufficiently with adequate drainpipe size. Drip eliminator shall be provided when air velocity across the cooling coil is higher than 2,5 m/s.

Sufficient ‘fresh’ outside air shall be supplied to the rooms/spaces for:

- occupants’ respirational needs
- to ensure that lower explosion limit for flammable vapours is not exceeded.
- to dilute toxic and volatile organic compounds (VOC) down to safe level
- to make up for exhaust air volumes
- to maintain the required pressurization regime

5.7.1 Particulate Filtration

Sand Trap louvers with associated filters shall be provided for all outdoor air intakes to the buildings. Sand Trap louvers shall be sized for maximum face velocity of approximately 1,5 m/s in order to maintain high filtration capability as well as low level of air resistance.

Sand trap louvers shall assure 90% efficiency of removing particles from 350 to 700 microns at 1m/s. Air intakes shall be installed at a minimum 1 meter above the flat surface on which they are located.

For more details on filtration refer to XXX.

5.7.2 Chemical Filtration

The provision of chemical filtration is dependent on the concentration of chemical contaminants (toxic, flammable and/or corrosive) present in the outside air and required indoor air quality (for personnel and equipment protection).

Type and quantity of chemical filter media shall be selected to provide a required ISA standard S71.04 environment and also complying with “Middle East Regulation” requirements for indoor air quality conditions. For further details on chemical filtration refer to XXX.

The long-term exposure to the corrosive environment may be covered by adequate specification of relevant electric and electronic equipment in order to maintain the required life expectancy. Regular inspection routines should monitor any impact.

5.7.3 Hazards

The project locations have corrosive environment where significant concentrations of air pollutants may be continuously present. Elevated levels of abrasive dust may be occurring frequently.

The design and selection of HVAC system electrical and instrumentation components shall comply with the project specific Hazardous Area Classification (HAC) documentation governed by applicable COMPANY’s as well as national and international standards. The HVAC system and components shall be suitable and certified for their installed location and may require protection for location within toxic, flammable, smoke, fire, heat radiation and blast overpressures environments.

All equipment and components shall be suitable for the hazards involved.

All facility envelope ingress and egress points shall be smoke, fire and airtight.

5.7.4 Gas

Toxic and Flammable gas detectors (H_2S, HC, etc.) shall be provided in the outdoor air intake as described in more details in XXX. There may be need for additional gas detectors, i.e., H_2 in the exhaust ducts from the Battery Rooms or within these rooms.

All gas detectors are included as part of the FGS and operate in accordance with the FGS cause and effect diagrams.

5.7.5 Smoke

Smoke detection shall be provided in accordance with “Client” Standards and other codes, and documents referenced herein.

5.7.6 Fire

HVAC distribution systems (ductwork, pipework, cabling) penetrating fire rated structure shall be routed through Fire Dampers or fire rated, gastight, transitional frames, or fire rated sleeves. The penetrations shall be rated to comply with the fire rating certification of the structure.

Service ingress and egress points shall not warp or cause premature collapse of system distribution under applicable fire conditions.

5.7.7 Heat Radiation

Suitable protection from heat radiation shall be provided as applicable in accordance with "Client" Standards and other codes and documents referenced herein.

5.7.8 Blast Pressure

As per writing of this document, there is not blast resistance of buildings defined. To be confirmed in the next project phase.

5.8 Equipment Sizing and Selection

HVAC equipment shall be new and sized in accordance with the requirements specified in this document.

All HVAC equipment and controls selected shall be of proven standard suitable for use in oil & gas environment.

The HVAC Equipment located outside shall be specified accordingly to ambient conditions.

The HVAC main control panel (HCP) shall be located inside in controlled environment. The requirements for handling/Installation of the HVAC equipment shall be addressed in the material handling report. Additional lifting facilities, if required, shall be determined.

For further details on HVAC Equipment refer to XXX.

5.9 Equipment Availability

The arrangement of HVAC plant to meet system design duties should be based on system criticality, failure consequences and reliability and repair times. HVAC systems that are safety of production-critical shall be capable of continuous operation unless HVAC down-time can be accepted by introduction mitigation measures.

Refrigeration plant shall be capable of running continuously at the lowest step of cooling capacity without any adverse effect.

5.10 Plant Access and Removal

All HVAC equipment/systems shall be designed to ensure adequate space provision for maintenance, servicing, removal of major components without disruption of adjoining plant, while allowing full operation of associated standby equipment.

Adequate pipe-work isolation valves and ductwork shut off dampers shall be provided for ease of removal, replacement, and servicing. This shall be applicable to all HVAC systems.

Ductwork, pipework, valve / damper assemblies and control items shall be positioned to enable safe and easy access for inspection and servicing and shall not compromise equipment removal.

The minimum height for HVAC equipment site-built base shall be 150 mm notwithstanding the equipment factory built base frame. The site-built base shall extend a minimum of 100 mm around the footprint of the HVAC equipment.

The equipment clearances shall be based upon the stipulations and recommendations of "Client" Standards and for particular cases involving space restrictions shall be based upon the recommendations of the HVAC equipment vendor or manufacturer. There should be an

adequate and suitable space from the access side of any HVAC equipment to the nearest possible obstruction. These clearances shall be free from any tripping hazard and or other possible unsafe condition that would compromise the safety and wellbeing of the facility personnel, especially operational and maintenance teams.

5.11 Structural Supports

The structural supports shall be adequately provided for all HVAC equipment, ductwork, piping, and associated duct/piping accessories. Supports shall be fabricated as per governing Industry Practices and should be robust and adequate to handle the load being supported. Loading points shall be properly identified and all applicable equipment shall be provided with vibration mounts.

5.12 Air Distribution

A network of supply, return and exhaust air ducts with adequate number and correctly applied volume control dampers shall provide desired distribution of air throughout the air conditioned or ventilated spaces.

For air-conditioned areas that are occupied by sedentary personnel the air distribution shall be such that air velocity is never more than 0,2 m/s.

Air terminals and uninsulated ductwork runs shall not be located directly above electrical or electronic equipment to prevent potential condensation damage.

5.13 Water Distribution

A network of flow and return water pipes with adequate number and correctly applied commissioning sets shall provide desired distribution of chilled water throughout the air-conditioned units.

5.14 Health, Safety, Security and Environment

Refer to XXX standard for further details.

5.15 Telecom Room (TR)

Air-Conditioning as per “Client” standard

a) Environmental conditions inside the room shall be dust-free and air-conditioned to maintain a temperature between 16 °C and 20 °C.

b) In addition to the centralised air-conditioning system (HVAC) provided in the Telecom Room of the building, an independent split type Air-Conditioning Unit shall also be provided in the room to maintain the required temperature, in the event of main (centralised) HVAC System failure.

c) The split A/C shall be wall mounted with proper routing of drainpipe and in a place where water drips from the split A/C, if any, shall not affect any active / passive equipment installed in the Telecom Room.

d) Split A/C shall be installed below the false ceiling and located away from the Cable tray to prevent condensate water from seeping on the Cable Tray.

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6 HVAC Systems

6.1 Air Conditioning

Acceptable Air Conditioning systems shall be selected from any of the below listed systems on the basis of suitability. Selection shall be accepted by COMPANY during the approval of Design Basis Memorandum.

Any of the acceptable systems shall provide the suitable air pressurization required for the spaces they serve. In most cases constant air volume systems, either DX (Direct Expansion) or Chilled Water, shall be taken into consideration.

Direct Expansion (DX) type HVAC system shall be used for buildings of total cooling load not exceeding 1.055 kW as stipulated in XXX.

For further details regarding plant selection and various energy conservation measures refer to “Middle East Regulation”.

6.1.1 Chilled Water Systems

Acceptable Chilled Water systems are based on chillers working with:

- Air Handling Unit (AHU)
- Fan Coil Unit (FCU)
- Close Control Unit (CCU), floor mounted indoor unit

6.1.2 DX Systems

Acceptable DX systems shall be based on air cooled condensing units (ACCU) working with:

- Packaged Air Conditioning Unit (PACU with in-built ACCU)
- Split Air Conditioning Unit (AHU with remote ACCU)
- Split Air Conditioning Unit (ducted FCU with remote ACCU)
- Split Air Conditioning Unit (FCU with remote ACCU), high wall/ ceiling
- mounted/ concealed FCU.
- Split Air Conditioning Unit (CCU with remote ACCU)

6.2 Heating

Heating systems shall provide the required internal temperature and may be arranged on centralized or localized basis depending on suitability.

For centralized systems, the heating may be provided by Constant Air Volume Boxes (CAV) with electric re-heat coils or duct mounted electric heaters. For local applications fan assisted Unit Heaters may be used.

6.3 Ventilation

Ventilation systems shall provide the required air quantity and pressurization for the spaces they serve and may be localized or centralized (ducted).

All air-conditioned spaces shall have a minimum quantity of ventilation air that is the highest of the following values:

1. 0,250 ACH for pressurization + exhaust air from kitchens, toilets, and other areas.

2. Recommended air quantity as given by the Ventilation Rate Procedure described in the latest version of the ASHRAE 62.1 Standard (Ventilation for Acceptable Indoor Air Quality). This new procedure ensures that the design outdoor airflow required in the breathing zone of the occupied space(s) is met by taking into account both the occupancy and floor area simultaneously. The effectiveness of the air distribution system shall be determined accordingly and used to obtain the final quantity of the required ventilation rate.

For further details refer to “Client” and “Middle East Regulation”.

6.4 Humidification

The humidity control shall be performed by use of electrically power Steam injection humidifier (via dispersion tubes) into ducted airstream. The fresh, odourless, and sterile steam shall be generated from potable water system supply. Dehumidification shall be performed by the way of mechanical cooling (using air conditioning units).

6.5 HVAC System Redundancy

As per writing of this document, HVAC systems Redundancy is not yet defined. Further investigation and developments shall be done in the future. To be confirmed in the next project phase.

6.6 Ingress Protection

The minimum Ingress Protection (IP) rating for all HVAC equipment and items shall be generally as described below:

- IP 55 for external location (with IP 65 for outdoor instrumentation)
- IP 43 for internal location

For further details on electrical motors and lighting fixtures refer to “Client” and “Middle East Regulation”.

6.7 Explosion Proof Protection

Whenever applicable, the electrical explosion protection for all HVAC equipment and its components shall be in conformance with the harmonized European Normative EN 60079 standard and IEC 60079 standard series.

Explosion proof protection shall deal with all types of predominant potential toxic and flammable gases within its hydrocarbon installations.

Intrinsic measures have to be carried out in order to avoid catastrophic results, loss, or damage of property. The assessment of the Hazardous Area Classifications (HAC) shall be essential in

preparation of the requirements for all HVAC equipment including preparation of narratives for the HVAC technical specifications.

The explosion proof protection rating classification shall be in accordance with the applicable "Client" standards and international codes, i.e., ATEX, UL/FM, CENELEC/ IEC 60079, ISA 60076, API, etc.

The HVAC electrical and C&I components located in the Battery Room shall be rated Zone 1, Gas Group IIC, T3.

Internal duct heaters shall be finless non-explosion proof type, manufacture standard and safe area classified. During gas situation, HCP will automatically trip duct heater unit, as applicable. Heater element outer temperature shall not exceed 150 ºC under normal operating air flow conditions.

6.8 Refrigerant

For new buildings, Standard 189.1 prohibits the use of CFC-based refrigerants in HVAC&R systems, as well as CFCs, hydrochlorofluorocarbons (HCFCs), and halons used in fire suppression systems.

When selecting refrigerants for HVAC equipment, designers should consider products with minimal ozone depleting potential (ODP) and global warming potential (GWP). When considering low ODP and GWP refrigerants, designers should also consider the total mass of refrigerant required and the impact the refrigerant type has on equipment efficiency.

The allowable working refrigerant for all DX air conditioning units and chillers shall have zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP). All Chlorofluorocarbon (CFC) and Hydrochlorofluorocarbon (HCFC) refrigerants such as R11, R12 and R22 shall not be used.

6.9 Energy Conservation

Systems shall be designed to current best practice for energy use and shall be in accordance with the "Middle East Regulation" publications and "Client" standard as applicable.

The Contractor shall obtain "Middle East Regulation" approval for the availability of the total electricity and water demands during the initial design stage as applicable. The CONTRACTOR shall in equivalent manner submit all the required documentation to "Middle East Regulation", to confirm that the regulations are fully complied with before commencement of any project and before ordering any equipment. If these regulations cannot be fully complied with due to design constrains the CONTRACTOR shall submit a detailed proposal justifying the reasons for non-adherence to the code for the prior approval of "Middle East Regulation" before tendering the project.

6.9.1 Maximum Allowable Power Rating

The "Middle East Regulation" stipulates the performance of the HVAC equipment and systems, and the governing values are additionally dependent on the implementation date. Refer to "Middle East Regulation" for more details.

6.9.2 Energy Recovery

For recoverable exhaust air quantity of 1.410 l/s or more the Cooling Recovery Units (CRU) at minimum efficiency of 75% shall be used to recover the energy form exhaust air streams. In case of perceived health hazards (i.e., toilet extracts) non-mixing CRU can be used (heat pipe, fixed plate, etc.) at minimum efficiency of 55%. A central exhaust system shall be

incorporated to facilitate the above requirement. For further details refer to “Middle East Regulation”.

6.9.3 Use of Variable Frequency Drives (VFD)

Motors of the supply air fans (i.e., AHU, PRU, PACU, etc.) and chilled water pumps as well as Chiller and ACCU compressors shall be equipped with VFD’s. Major drives behind that requirement are maintaining the air flow/pressurization level (i.e., AHU, PACU, PRU, etc.), energy savings, and ease of turndown and commissioning. All mini-split units shall be inverter type as well. Refer to “Middle East Regulation” for further details.

6.9.4 Programmable Thermostats

Refer to “Middle East Regulation” for further details.

6.9.5 Electrical Motors for HVAC

For details on electrical motors refer to XXX and “Middle East Regulation”.

6.10 Maintenance Philosophy

For Maintenance and Spare Parts data refer to XXX and XXX.

7 HVAC Ducting and Accessories

Duct sizing criteria and technical details about ducting along with insulation shall be considered during the design. Both supply and return ducts shall be thermally insulated to prevent condensation. Condensation within the building shall be prevented by proper sealing of service penetrations. Vapor barrier shall be applied to refrigerant piping and ducts.

Ducts shall be formed from sheet steel with hot dip galvanized coating. Average thickness of zinc coating shall be equivalent to not less than 0,6 kg/m² of zinc for all surfaces. Duct elements shall be constructed for optimal duct air flow, for example by using baffle plates, turning vanes, reversing blades, etc. so that air turbulence, air borne noise and pressure losses are minimized. Flexible ductwork shall not be used unless necessary, however length is to be minimized (maximum length 1,0m). Ductwork shall be designed to minimize noise transmission and to avoid noise generation from components or fittings. Duct construction for metal and flexible ducts shall be in accordance with SMACNA Standards. Duct insulation shall comply with ASTM E84 and NFPA 220 standards.

Ductwork air velocity shall not exceed the following limits:

- Mains 8 m/s
- Branches 6 m/s
- Run outs 4 m/s

All equipment and ducting shall be arranged to provide required clearance for installations, operation, inspection, maintenance and dismantling with the minimum interference or removal of ducting and equipment. Accessibility and maintenance doors shall be installed in ductwork.

All ducts penetrating the fire walls, roof and floor shall have fire dampers. The rating of fire dampers shall be same as the rating of the walls, roof, or floor.

Pre-insulated phenolic duct and fireproofed duct shall be used as required.

For further details about HVAC duct design, duct work and accessories please refer to XXX.

8 HVAC Pipework

Refrigerant piping, chilled water piping (if required) and drain piping shall be considered as applicable.

Refrigerant piping shall be water tube size hard drawn copper tubing conforming to ASTM B 88 Type L.

Chilled water piping shall be seamless ASTM A53, Schedule 40 black steel pipe, Grade A, except Grade B for bending purposes.

Condensate drainpipe shall be closed-cell elastomeric insulated pipe.

Chilled water pipe sizing shall consider a water velocity of 2 m/s in accordance with ASHRAE Fundamentals, Chapter 22, Pipe Sizing.

Condensate drain piping shall be connected directly to the sewerage system.

Pipe insulation shall comply with ASTM E84 and NFPA 220 standards.

For further details about HVAC piping, accessories and thermal insulation please refer to XXX.

9 Power, Controls & Instrumentation

9.1 General

All HVAC related electrical works shall comply with “Client” Standards for Electrical Engineering. For operating power supply detailed characteristics refer to XXX, generally the HVAC Equipment shall operate on main power supply as listed below:

- 440 V, 3 phase, 4 wire, 50 Hz,
- 250 V, single phase, 50 Hz,

The HVAC Control system using Direct Digital Controller (DDC) technology shall be provided. DDC shall be programmed, and logic shall be written for the control sequence, logic interlock and protection scheme. The HVAC DDC shall interface with the F&G System.

All HVAC DDC and electrical panel shall have the facility for local laptop connection for service and set point modification as required.

HVAC equipment (duty and standby) shall be powered from dual power sources. Hardwired interface signals shall include (but not be limited to):

- Digital - Fault to FGS.
- Digital - Shutdown of HVAC / confirmed signal exchange with FGS.
- Digital - Closure of all Fire / Smoke dampers / confirmed signal exchange with FGS.
- Digital - Clean agent released (to initiate HVAC purge delay timer) from clean agent control where clean agent system is installed. HVAC equipment to be suitably specified.
- Digital - Combustible gas detected at HVAC intake duct (shutdown and damper closure, as required).

For serial link communication, the HVAC DDC shall include Profibus, or Modbus connection and shall be prepared for future use with an easy quick connection.

A detailed HVAC I/O list shall be prepared, and all the control philosophy will be detailed in the next engineering phase.

The HVAC System shall be hard wired interlocked with fire alarm system and fire suppression system (if any) and in case of signal either from fire alarm and / or fire suppression system,

the complete HVAC system will trip (Except the Battery Room Exhaust Fans in Substation) and shall have to be reset manually for restarting. Such interlock can be achieved through an interposing relay panel, if necessary.

The HVAC Control panel shall have the following minimum contacts for each of the Annunciation Panel, DCS Panel and SCADA / DAP. Any further additions can be done to the below list as specified in the project document:

1) HVAC machine failure.
2) HVAC running.
3) HVAC stopped.
4) Module loss of pressure.

The HVAC Control System shall be provided with all important status indication signals like HVAC on / running, HVAC common fault, HVAC alarm, etc. as minimum to the DCS.

The E-SCADA System shall be capable of communication between various Equipment / Systems, which shall include but not limited to the following:

a) Switchgear (all voltage levels) / Generator / Transformer / UPS / Battery Chargers / Substation HVAC System / Substation Fire & Gas Detection System / Fire Suppression Systems and other equipment as specified in the Project Documents.

b) Various protection systems / relays. DOC. NO. XXX

c) DCS (via. open communication protocol such as OPC UA or any other protocol compatible with the DCS as applicable).

9.2 Critical Loads

These are loads of prime importance to the safety of the installation & operational staff, which require power to permit the safe shutdown of the plant in an emergency. These shall be generally associated with “No Break Supplies” (UPS / DC Battery Charger etc.), backed up with emergency generator. The critical loads shall include but not limited to the following:

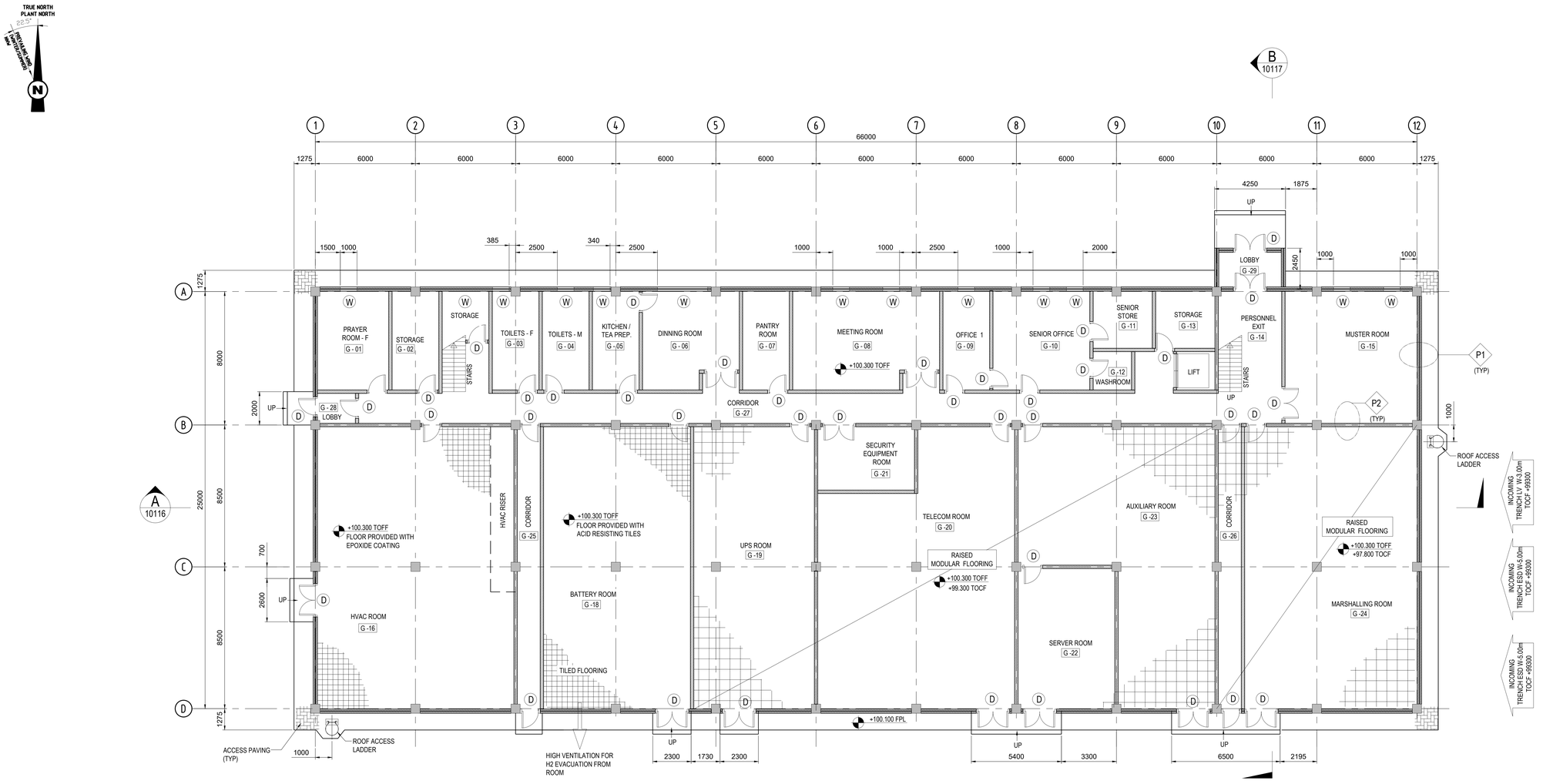
PCS, ESD System, E-SCADA System, F&G System, Fire Suppression Control System, CCTV / Security systems, BMS, Power Supply for IRP, Condition Monitoring System, Turbine Control System, Compressor Control System, Power Supply for Telecommunication Systems, Power supply for Instrumentation System and any other loads, as specified in the Project Documents.

Anexo III

Desenhos de Arquitectura

Desenhos fazem parte do projecto original. Serviram de base para o desenvolvimento do modelo 3D criado no programa HAP 6.2. Por motivos de confidencialidade, estes desenhos foram editados para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente:

1 Ground Floor
2 First Floor
3 Second Floor
4 Roof
5 Section AA
6 Section BB
7 North & South Elevations
8 West & East Elevations



GROUND FLOOR PLAN

TOFF+100300

(SCALE 1:100)

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.
5. BATTERY ROOM TO HAVE ACID ALKALI RESISTANT TILES ON FLOOR AND WALLS ALL ROUND TO 2100 HIGH DADO

LEGEND :-

FFL - FINISH FLOOR LEVEL
TOC - TOP OF CONCRETE
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR
FPL - FINISH PAVEMENT LEVEL
D - DOOR
W - WINDOW

TILED FLOORING (SEE NOTE 5)

RAISED MODULAR FLOORING

HERRING BONE PATTERN 50 THK PRECAST CONCRETE PAVEMENT TILES

KEY PLAN

0 2 4 6 8 10 m

1:100

ROOM KEY

ROOM NO.	ROOM DESCRIPTION	ROOM AREA (m²)
G - 01	PRAYER ROOM - F	27.00 m²
G - 02	STORAGE ROOM	18.00 m²
G - 03	TOILETS - F	18.00 m²
G - 04	TOILETS -M	18.00 m²
G - 05	KITCHEN / TEA PREP.	18.00 m²
G - 06	DINNING ROOM	36.00 m²
G - 07	PANTRY ROOM	18.00 m²
G - 08	MEETING ROOM	54.00 m²
G - 09	OFFICE	18.00 m²
G - 10	SENIOR OFFICE	36.00 m²
G - 11	SENIOR STORE	13.125 m²
G - 12	WASHROOM	6.25 m²
G - 13	STORAGE	13.125 m²
G - 14	PERSONNEL EXIT	32.40 m²
G - 15	MUSTER ROOM	64.00 m²
G - 16	PRIMARY HVAC ROOM	204.00 m²
G - 17	HVAC RISER	18.75 m²
G - 18	BATTERY ROOM	153.00 m²
G - 19	UPS ROOM	126.00 m²
G - 20	TELECOM ROOM	180.00 m²
G - 21	SECURITY EQUIPMENT ROOM	24.00 m²
G - 22	SERVER ROOM	51.00 m²
G - 23	AUXILIARY ROOM	153.00 m²
G - 24	MARSHALLING ROOM	204.00 m²
G - 25	CORRIDOR	26.775 m²
G - 26	CORRIDOR	26.775 m²
G - 27	CORRIDOR	111.00 m²
G - 28	LOBBY	4.75 m²
G - 29	LOBBY	9.30 m²

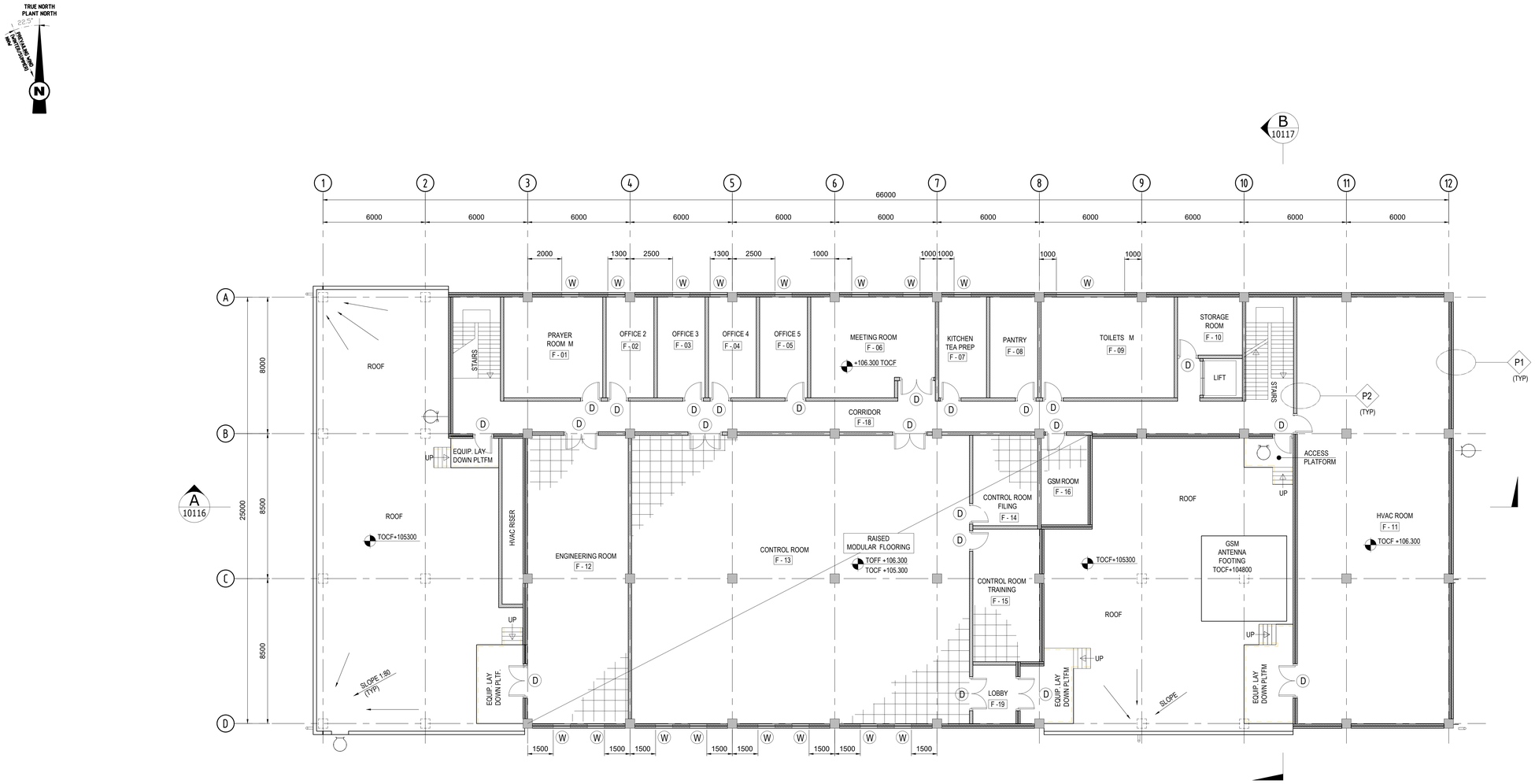
LEGEND - WALL TYPE

TAG	SYMBOL	DESCRIPTION
P1		100 mm THK (MIN) EXTERNAL WALL + 50 mm GAP + 100 mm THK INSIDE WALL 20 THK INSIDE / EXTERNAL PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY
P2		200 THK INTERNAL CMU WALL (CONCRETE MASONRY UNIT) (20 THK INSIDE PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY)

TABLE OF FLOOR BEAMS

Nos.	DESCRIPTION	SIZES	
		HEIGHT	WIDTH
01	PLINTH BEAMS	800	500

A0



FIRST FLOOR PLAN

TOCF+105300 / TOCF+106300

(SCALE 1:100)

ROOM KEY

ROOM NO.	ROOM DESCRIPTION	ROOM AREA (m²)
F - 01	PRAYER ROOM M	18.00 m²
F - 02	OFFICE	18.00 m²
F - 03	OFFICE	18.00 m²
F - 04	OFFICE	18.00 m²
F - 05	OFFICE	18.00 m²
F - 06	MEETING ROOM	45.00 m²
F - 07	KITCHEN TEA PREP	18.00 m²
F - 08	PANTRY	18.00 m²
F - 09	TOILETS M	48.00 m²
F - 10	STORAGE ROOM	14.00 m²
F - 11	SECONDARY HVAC ROOM	225.00 m²
F - 12	ENGINEERING ROOM	102.00 m²
F - 13	CONTROL ROOM	306.00 m²
F - 14	CONTROL ROOM FILING	22.00 m²
F - 15	CONTROL ROOM TRAINING	32.00 m²
F - 16	GSM ROOM	15.00 m²
F - 17	GSM ANTENNA FOOTING	25.00 m²
F - 18	CORRIDOR	99.01 m²
F - 19	LOBBY	10.00 m²

LEGEND - WALL TYPE

TAG	SYMBOL	DESCRIPTION
P1		100 mm THK (MIN) EXTERNAL WALL + 50 mm GAP + 100 mm THK INSIDE WALL 20 THK INSIDE / EXTERNAL PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY
P2		200 THK INTERNAL CMU WALL (CONCRETE MASONRY UNIT) (20 THK INSIDE PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY)

TABLE OF FLOOR BEAMS

Nos.	DESCRIPTION	SIZES	
		HEIGHT	WIDTH
01	PLINTH BEAMS	800	500

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

LEGEND :-

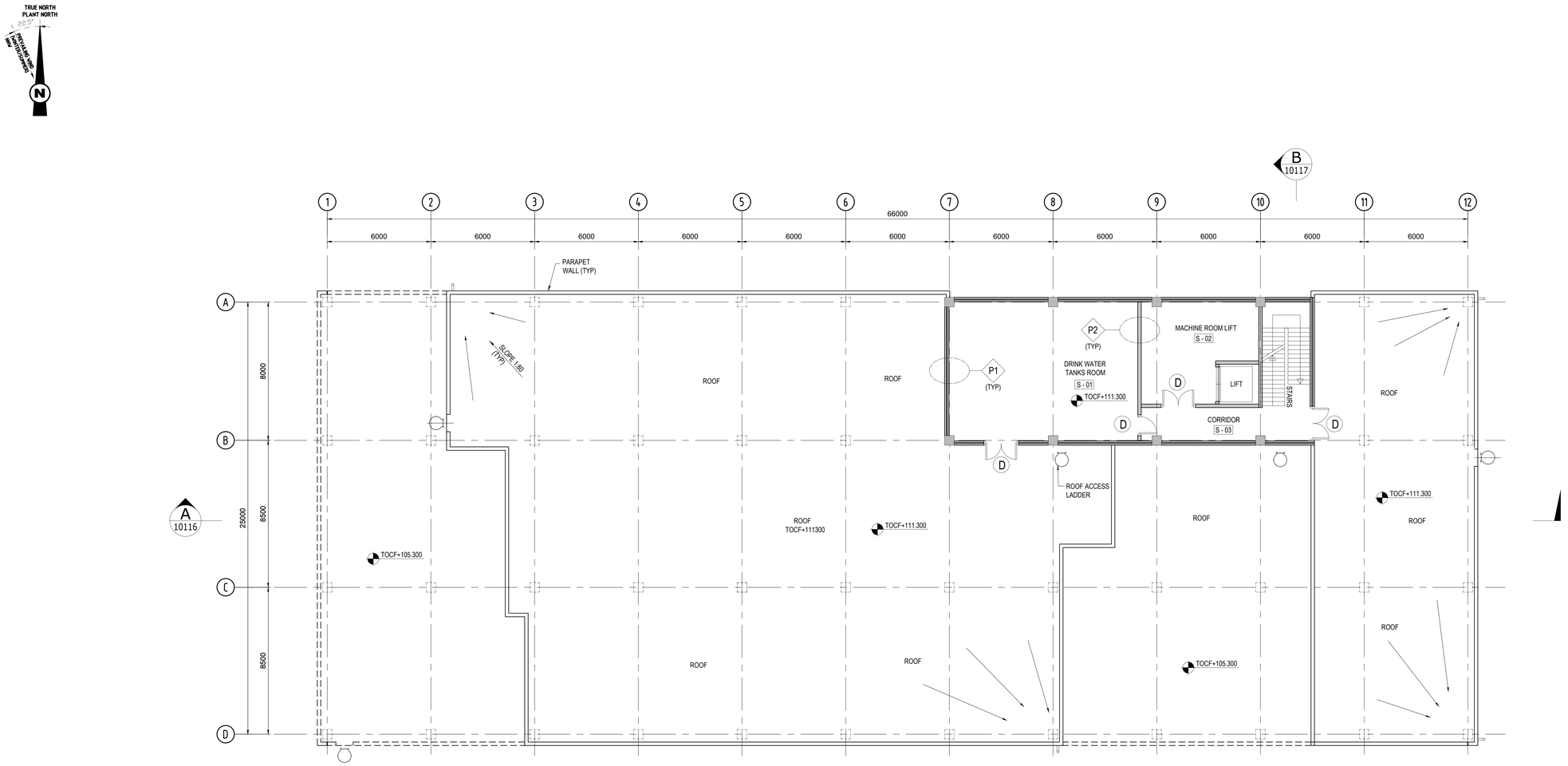
FFL - FINISH FLOOR LEVEL
TOC - TOP OF CONCRETE
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR
D - DOOR
W - WINDOW
RAISED MODULAR FLOORING

KEY PLAN

0 2 4 6 8 10 m

1:100

A0



2nd FLOOR PLAN
TOCF+111300
(SCALE 1:100)

ROOM KEY

ROOM NO.	ROOM DESCRIPTION	ROOM AREA (m²)
S - 01	DRINK WATER TANKS	88.00 m²
S - 02	MACHINE ROOM LIFT	60.00 m²
S - 03	CORRIDOR	14.00 m²
S - 04	HVAC RISER	0.50 m²

LEGEND - WALL TYPE

TAG	SYMBOL	DESCRIPTION
P1		100 mm THK (MIN) EXTERNAL WALL + 50 mm GAP + 100 mm THK INSIDE WALL 20 THK INSIDE / EXTERNAL PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY
P2		200 THK INTERNAL CMU WALL (CONCRETE MASONRY UNIT) (20 THK INSIDE PLASTER LINE IS NOT SHOWN IN PLAN FOR CLARITY)

TABLE OF FLOOR BEAMS

Nos.	DESCRIPTION	SIZES	
		HEIGHT	WIDTH
01	PLINTH BEAMS	800	500

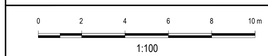
NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

LEGEND :-

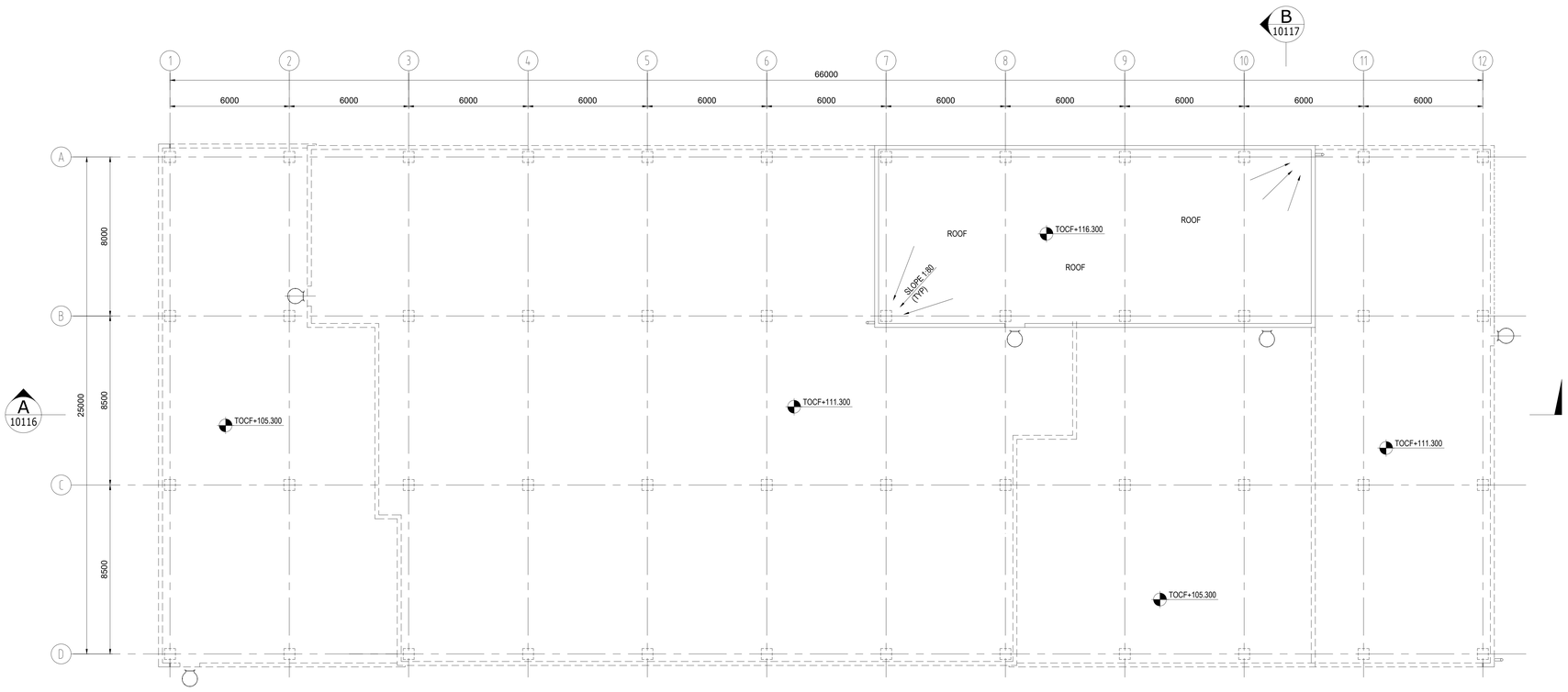
TOCF - TOP OF CONCRETE FLOOR
D - DOOR
W - WINDOW

KEY PLAN



1:100

A0



ROOF PLAN
TOCF+116300
(SCALE 1:100)

TABLE OF FLOOR BEAMS

Nos.	DESCRIPTION	SIZES	
		HEIGHT	WIDTH
01	ROOF BEAMS	500	500

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

LEGEND :-

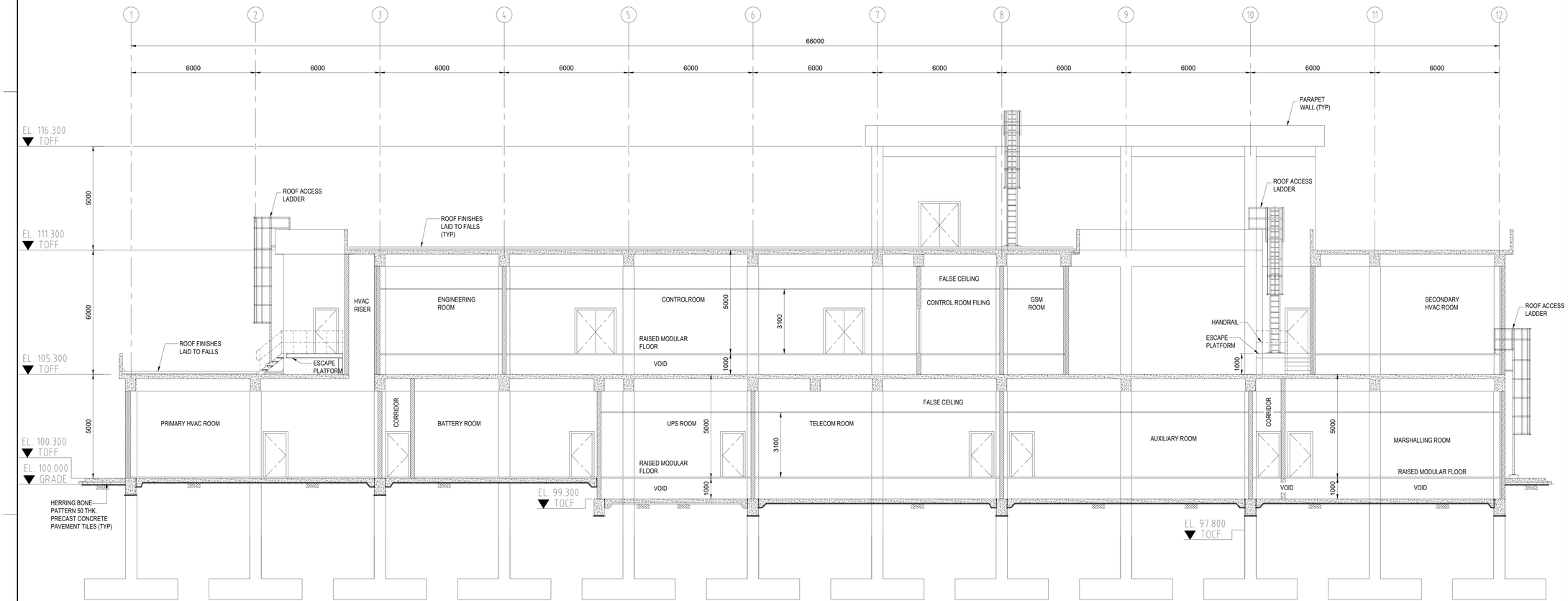
TOCF - TOP OF CONCRETE FLOOR

KEY PLAN

0 2 4 6 8 10 m

1:100

A0



SECTION A-A
SCALE 1 : 75

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.
5. BATTERY ROOM TO HAVE ACID ALKALI RESISTANT TILES ON FLOOR AND WALLS ALL ROUND TO 2100 HIGH DADO

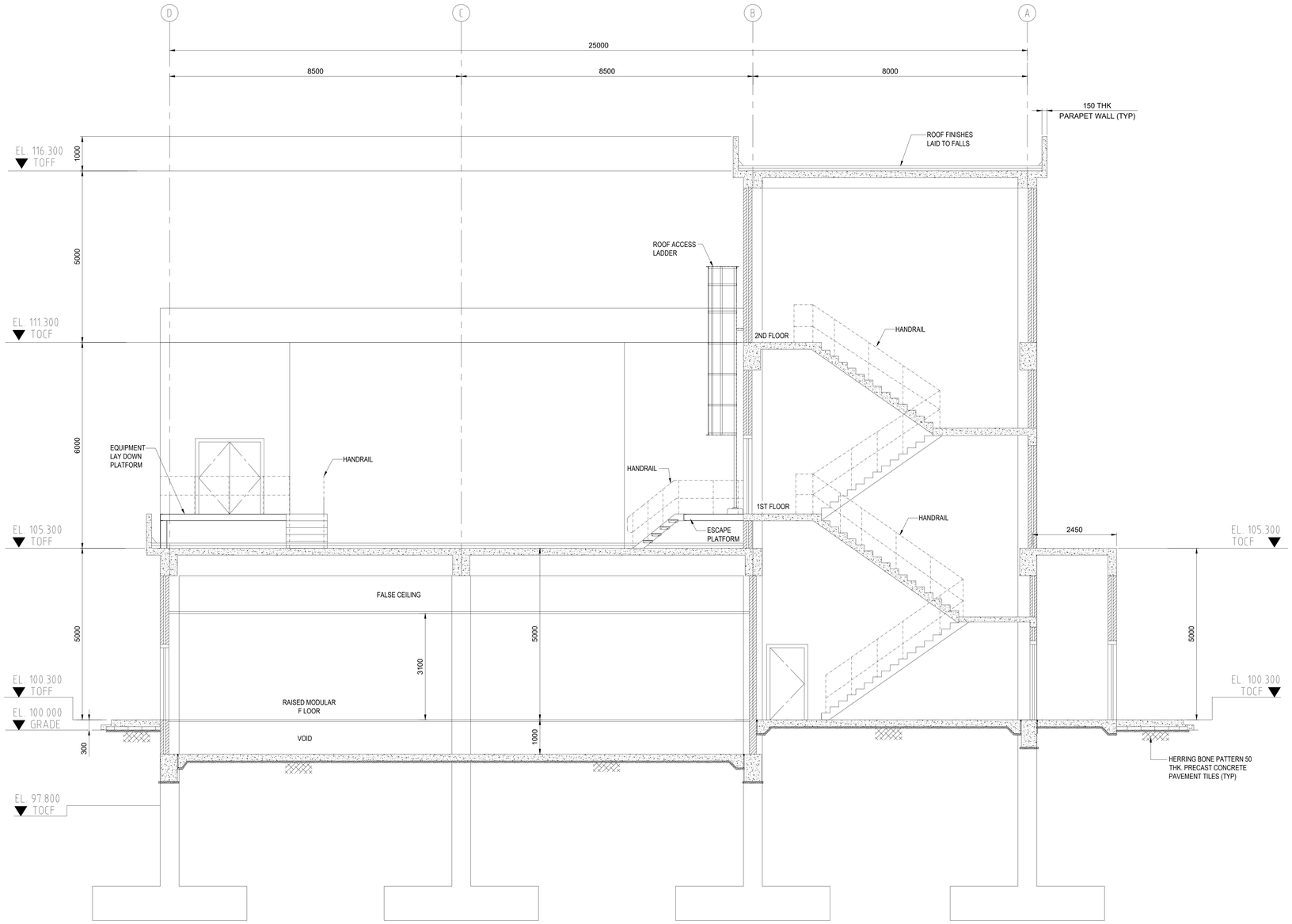
LEGEND :-

FPL - FINISH PAVEMENT LEVEL
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR

KEY PLAN

0 1 2 3 4 5 6 7 8 m
1:75

A0



SECTION B-B
SCALE 1 : 50

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

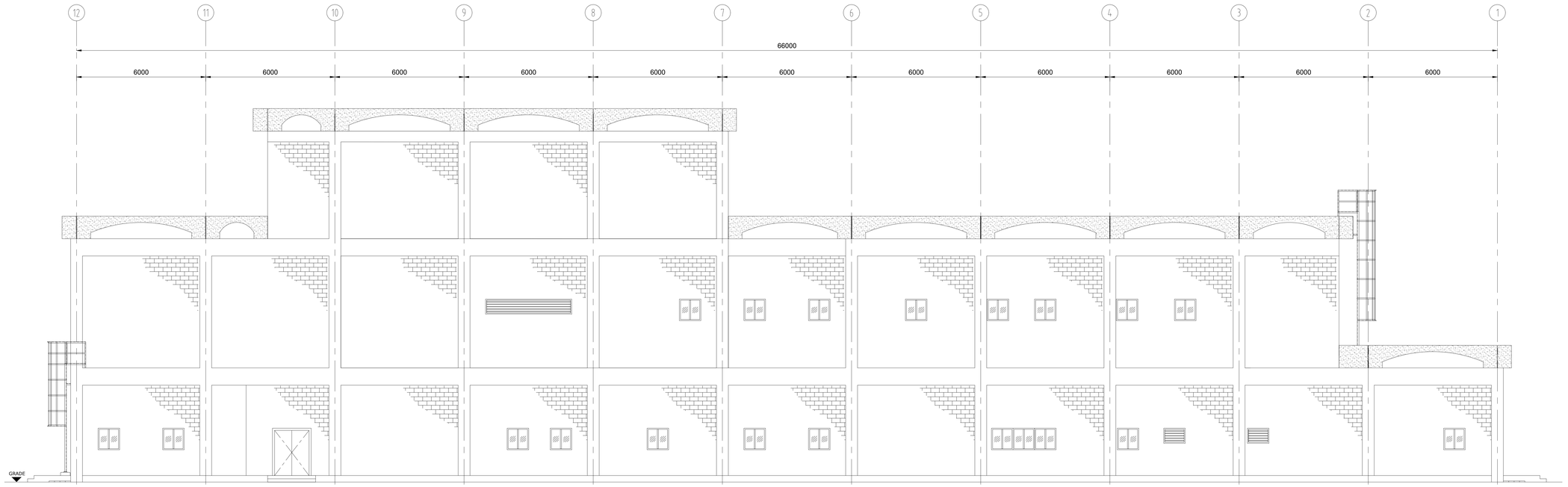
LEGEND :-

FPL - FINISH PAVEMENT LEVEL
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR

KEY PLAN

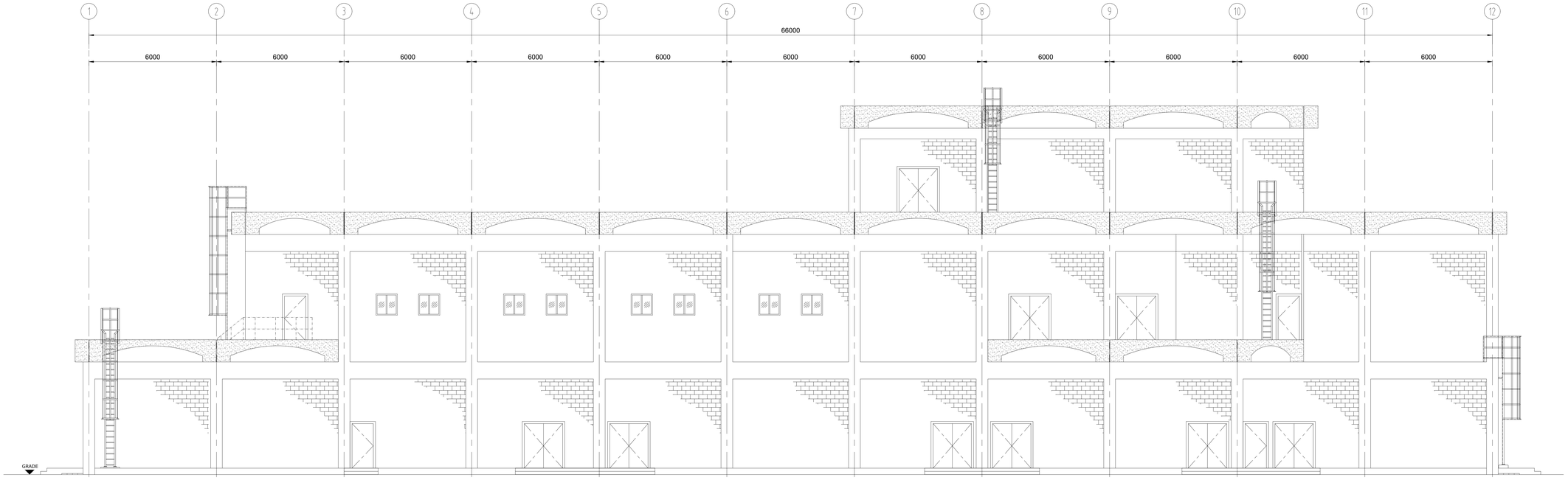
0 1 2 3 4 5 m
1:50

A0



NORTH ELEVATION

SCALE 1 : 75



SOUTH ELEVATION

SCALE 1 : 75

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

LEGEND :-

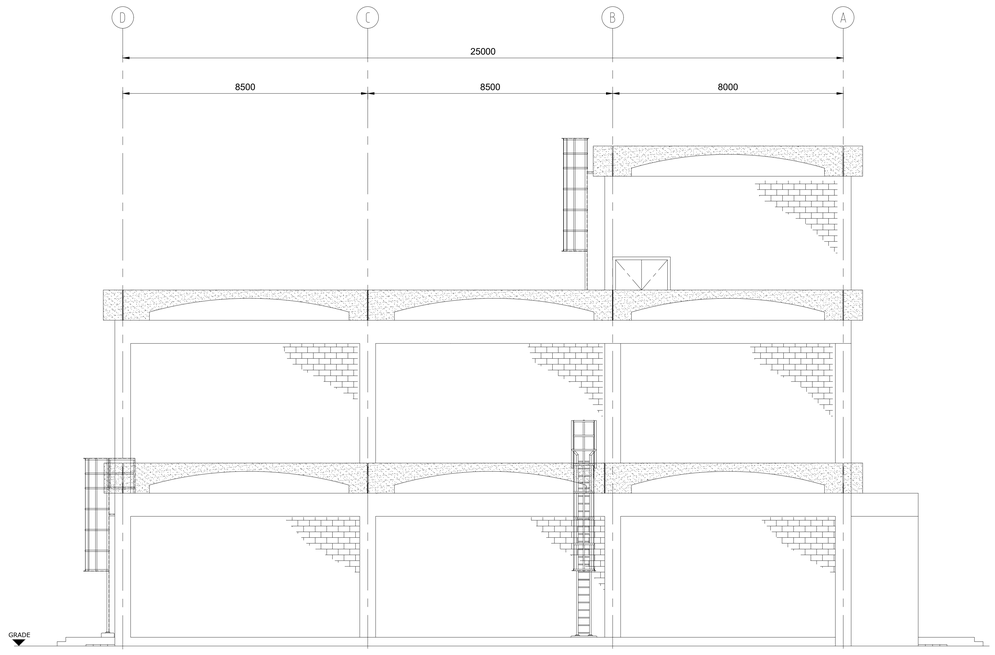
FPL - FINISH PAVEMENT LEVEL
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR

KEY PLAN

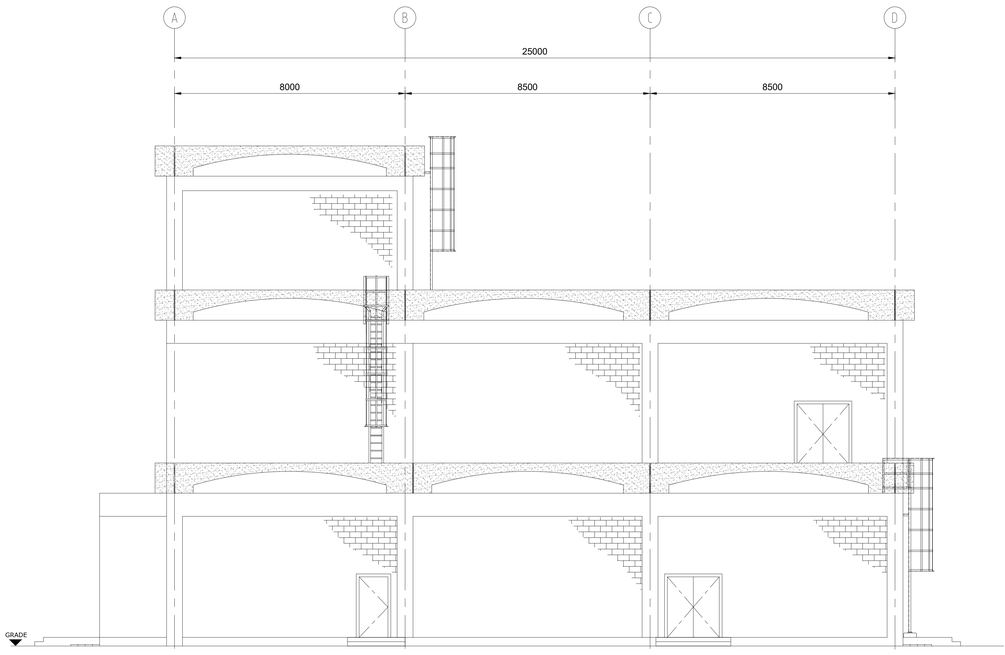
0 1 2 3 4 5 6 7 8 m

1:75

A0



EAST ELEVATION
SCALE 1 : 75



WEST ELEVATION
SCALE 1 : 75

NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2.
3.
4.

LEGEND :-

FPL - FINISH PAVEMENT LEVEL
TOFF - TOP OF FINISH FLOOR
TOCF - TOP OF CONCRETE FLOOR

KEY PLAN

0 1 2 3 4 5 6 7 8 m
1:75

A0

Anexo IV

Building Envelope Calculations

Folha Excel que faz parte do projecto original e que serviu para calcular os coeficientes de transmissão U usados no programa HAP 6.2. Por motivos de confidencialidade, este documento foi editado para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

1 Original

2 Alternativa Envolvente

Project: Issue:
Client: Building Envelope - Original Issue Date:
Doc. No:

Exterior Wall - Above grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
290	**TOTAL**				**0,752**
Overall U-Value					**1,330 W/m².°C**

Column / Beam 0.24 m height

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
550	Structural concrete Column/Beam	2,100	2 300	1 265	0,262
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
570	**TOTAL**				**0,514**
Overall U-Value					**1,946 W/m².°C**

Exterior Wall - Above grade - Average

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
4	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	7	0,003
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
3	Projected plaster, 600 to 900 kg/m³	0,300	750	2	0,011
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
257	**TOTAL**				**0,684**
Overall U-Value					**1,462 W/m².°C**

Exterior Wall - Below grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
100	Concrete block, 100 mm	0,000	1 350	135	0,160
50	Air space; horizontal flow, 15 < T < 300 mm	0,000	0	0	0,180
100	Concrete block, 100 mm	0,000	1 350	135	0,160
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
270	**TOTAL**				**0,697**
Overall U-Value					**1,435 W/m².°C**

Roof

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W	
-	Outdoor Air	0,000	0	-	0,040	
100	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	180	0,077	
50	Roofmate (XPS)	0,037	32	2	1,351	As in drowing
5	Waterproofing with impregnated flexible membrane with bitumen	0,230	1 050	5	0,022	
200	Structural concrete slabs	2,100	2 300	460	0,095	
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067	
-	Indoor Air. Vertical upward flow (roofs/floors)	0,000	0	-	0,100	
375	**TOTAL**				**1,752**	
Overall U-Value					**0,571 W/m².°C**	

Floor on/below grade

U-Value - ***maximum***

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W	
-	Indoor Air. Vertical downward flow (floors)	0,000	0	-	0,170	
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008	
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038	
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121	
50	Floormate (XPS)	0,037	32	2	1,351	As in drowing
310	**TOTAL**				**1,689**	
Overall U-Value					**0,592 W/m².°C**	

Interior Wall

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
240	**TOTAL**				**0,693**
Overall U-Value					**1,442 W/m².°C**

Interior Floor

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
280	**TOTAL**				**0,574**
Overall U-Value					**1,742 W/m².°C**

Exterior Wall - Above grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
80	Wallmate (XPS)	0,037	30	2	2,162
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
320	**TOTAL**				**2,714**
Overall U-Value					**0,368 W/m².°C**

Column / Beam 0.24 m height

U-Value - ***maximum*** 0,398 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Outdoor Air	0,000	0	-	0,040
20	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	36	0,015
80	Wallmate (XPS)	0,037	30	2	2,162
550	Structural concrete Column/Beam	2,100	2 300	1 265	0,262
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
570	**TOTAL**				**2,676**
Overall U-Value					**0,374 W/m².°C**

Exterior Wall - Below grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
+ 80	Wallmate (XPS)	0,037	30	2	2,162
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
300	**TOTAL**				**2,659**
Overall U-Value					**0,376 W/m².°C**

Roof

U-Value - ***maximum*** 0,398 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W	
-	Outdoor Air	0,000	0	-	0,040	
100	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	180	0,077	
80	Roofmate (XPS)	0,037	32	3	2,162	Min. Thickness to achieve requirement
5	Waterproofing with impregnated flexible membrane with bitumen	0,230	1 050	5	0,022	
200	Structural concrete slabs	2,100	2 300	460	0,095	
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067	
-	Indoor Air. Vertical upward flow (roofs/floors)	0,000	0	-	0,100	
405	**TOTAL**				**2,563**	
Overall U-Value					**0,390 W/m².°C**	

Floor on/below grade

U-Value - ***maximum*** 0,568 W/m².°C

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W	
-	Indoor Air. Vertical downward flow (floors)	0,000	0	-	0,170	
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008	
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038	
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121	
60	Floormate (XPS)	0,037	32	2	1,622	Min. Thickness to achieve requirement
320	**TOTAL**				**1,959**	
Overall U-Value					**0,510 W/m².°C**	

Interior Wall

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
200	Concrete block, 200 mm	0,000	1 125	225	0,300
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Horizontal flow (walls)	0,000	0	-	0,130
240	**TOTAL**				**0,693**
Overall U-Value					**1,442 W/m².°C**

Interior Floor

Thickness mm	Material	Conductivity (λ) W/m.°C	Density (ρ) kg/m³	Int. Sup. Mass kg/m²	Resistance (R) m².°C/W
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
10	Glazed ceramic or stoneware (Ceramic Tiles)	1,300	2 300	23	0,008
50	Mortar and traditional grout, 1.800 a 2.000 kg/m³	1,300	1 800	90	0,038
200	Concrete (Average of normal concrete)	1,650	2 150	430	0,121
20	Projected plaster, 600 to 900 kg/m³	0,300	750	15	0,067
-	Indoor Air. Vertical downward flow (floors)	0,000	0		0,170
280	**TOTAL**				**0,574**
Overall U-Value					**1,742 W/m².°C**

Anexo V

Room Criteria List

Folha de Excel que faz parte do projecto original (projecto base) que é uma lista de espaços onde são compilados todos os requisitos dos espaços. Esta informação é utilizada para configurar todos os parâmetros dos espaços e sistemas no programa HAP 6.2. Após efectuados os cálculos no HAP 6.2, os resultados são resumidos nestas folhas. Por motivos de confidencialidade, estes documentos foram editados para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

1 Original
2 Alternativa Envolvente
3 Alternativa Chiller e Bomba de Calor

HVAC Design Parameter List - Original

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Site Coordinates		
Latitude	Longitude	Altitude
Middle East country		132 m

Outside Design Conditions - Summer: 51,7 °C DB | 28,9 °C WB | 18,7 % RH (1)
Outside Design Conditions - Winter: 4,5 °C DB | 2,0 °C WB | 64,6 % RH (1)

| Room Number | Room Description | Classification | Area [m²] | Height [m] | Height (Average) [m] | Volume [m³] | Openings Perimeter Windows [m] | Openings Perimeter Doors [m] | People [#] | Activity Level | __ to __ Schedule | Room Pressure [Pa] | Temperature (Winter - Summer) [°C] | Relative Humidity (min - max) [%] | Min. Supply Temperature [°C] | Minimum Exhaust [m³/h] | Rate Outside air (Occupied spaces) (per person) [m³/h.P] | Rate Outside air (Occupied spaces) (per area) [m³/h.m²] | People density [m²/P] | Occupation [#] | Fresh Air Calculation Standard | Minimum Outside air (for People) [m³/h] | Minimum Air change Rate (for Ventilation Purposes) [1/h] | Minimum Outside air (for Ventilation Purposes) [m³/h] | Minimum Outside air (for overpressure) [m³/h] | Minimum Outside air (for compensating local extracts) [m³/h] | Ventilation Efficiency [%] | Minimum Fresh Air [m³/h] | Supplied Fresh Air [m³/h] | Supplied Fresh Air [l/s] | Resulting Fresh Air Rate [1/h] | Extract Air [m³/h] | Extract Air [l/s] | Overpressure [m³/h] | Overpressure [l/s] | Resulting Fresh Air Rate [1/h] | Cooling Y/N | Heating Y/N | Ventilation Y/N | Humidification Y/N | Dehumidification Y/N | Monitoring of Natural Gases Y/N | Monitoring of Relative Humidity Y/N | Monitoring of Pressure Y/N | EX Y/N | Outside Air gas detection Y/N | Redundant System Y/N | 100% Fresh Air Y/N | Fire Protection [h] | Blast Resistant/Proof P/R/N | Air Tight Y/N | Max. Noise Level [NC] | Filter 1 Type | Filter 2 Type | Inertial Sand Filter Y/N | Sand Louvre Y/N | Chemical Filter Y/N |
|---|---|---

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Room Number	Room Description	People Load (Sensible) [W]	People Load (Latent) [W]	Internal Heat load (Lighting) [W/m²]	Internal Heat load (Lighting + 10% for Ballast) [W]	Internal Heat load - Equipment (Sensible) (15) [W]	Internal Heat load - Equipment (Latent) [W]	Safety Factor [%]	**Fresh Air (AHU)** [m³/h]	Fresh Air (AHU) [l/s]	**Supply Air Flow (AHU)** [m³/h]	Supply Air Flow (AHU) [l/s]	**Return Air (AHU)** [m³/h]	Return Air (AHU) [l/s]	**Extract Air (Fan)** [m³/h]	**Overpressure** [m³/h]	**Reheat Coil Capacity (Electrical)** [kW]	**CAV / VAV**	Cooling Power Sensible [kW]	Cooling Power Latent [kW]	**Cooling Power Total** [kW]	Supply temperature [°C]	**Heating Power Total (Electrical)** [kW]	Supply temperature [°C]	Heating (Electric) [kW]	Dehumidification Reheat (Electrical) [kW]	Fresh Air Fans Electrical [kW]	Supply Fans Electrical [kW]	Exhaust Fans Electrical [kW]	**Humidifier Water** [kg/h]	Humidifier Electrical [kW]	**Electrical** [kW]	Common Units	Local Units	Remarks
Control Building																																			
Ground Floor																																			
G-14+G-27	Corridor (0) + Stairs + Personnel Exit	0	0	5	777			10%	**300**	83	**530**	146	**230**	64	**0**	**0**	**3,3**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-29	Lobby (North)	0	0	5	43			10%	**600**	167	**600**	167	**0**	0	**0**	**600**	**3,8**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-28	Lobby (West)	0	0	5	23			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-25	Corridor (SW)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-26	Corridor (SE)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-12	Washroom (Senior Office)	0	0	5	29			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.1	
G-04	Toilet M	0	0	5	91			10%	**650**	181	**650**	181	**0**	0	**750**	**0**	**4,1**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.2	
G-03	Toilet F	0	0	5	89			10%	**600**	167	**600**	167	**0**	0	**700**	**0**	**3,8**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.2	
G-06	Dining Room	674	352	5	172			10%	**600**	167	**900**	248	**300**	83	**600**	**0**	**3,8**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-05	Kitchen / Tea Prep. 0	337	176	5	90	1 512		10%	**300**	83	**780**	216	**0**	0	**880**	**0**	**1,9**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV + EF 0.1.3	
G-07	Pantry Room (0)	0	0	5	91			10%	**550**	153	**550**	153	**0**	0	**550**	**0**	**3,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-01	Prayer Room F	359	301	5	139			10%	**300**	83	**1 100**	304	**800**	222	**300**	**0**	**1,9**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-15	Muster Room	718	601	5	343	195		10%	**550**	153	**1 660**	459	**1 110**	308	**550**	**0**	**3,5**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-10	Senior Office	144	120	5	188	190		10%	**150**	42	**710**	195	**560**	156	**150**	**0**	**1,3**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-09	Office 1	72	60	5	91	95		10%	**100**	28	**360**	99	**260**	72	**100**	**0**	**0,7**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-08	Meeting Room (0)	1 077	902	5	269	700		10%	**750**	208	**1 390**	386	**640**	178	**750**	**0**	**4,7**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-13	Storage (East)	0	0	5	67			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-02	Storage (West)	0	0	5	90			10%	**250**	69	**250**	69	**0**	0	**250**	**0**	**1,6**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
	Storage (Stairs)	0	0	5	45			10%	**150**	42	**150**	42	**0**	0	**150**	**0**	**0,9**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-11	Senior Store	0	0	5	66			10%	**150**	42	**150**	42	**0**	0	**150**	**0**	**0,9**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-16	HVAC Room (0)	0	0	5	1 092			10%	**600**	167	**3 960**	1 099	**3 360**	933	**0**	**600**	**0,0**	**VAV**														**0,0**	AHU 0.1	VAV	
Total									**8 200**	2 278	**15 940**	4 416	**7 260**	2 017	**6 280**	**2 400**	22 470																		
AHU 0.1 (Office 0)									**8200-8680**		**8200-15940**		**0-7260**		**3 750**				127,5	45,5	**173,0**	14,2	**19,7**	13,0	19,7	14,2		**7,38**		**49,41**	37,2	76,6			
Exhaust Fan (EF 0.1.1)															**200**														**0,03**			0,0			
Exhaust Fan (EF 0.1.2)															**1 450**														**0,2**			0,2			
Exhaust Fan (EF 0.1.3)															**400-880**														**0,1**			0,1			
Electrical																	49,8															126,7			
1st Floor																																			
F-18	Corridor (1) + Stairs	0	0	5	714			10%	**1 300**	361	**2 580**	715	**1 280**	356	**0**	**1 100**	**8,2**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-19	Lobby (Control Room)	0	0	5	48			10%	**600**	167	**600**	167	**0**	0	**0**	**600**	**3,8**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-09	Toilet M	0	0	5	253			10%	**1 750**	486	**1 750**	486	**0**	0	**1 850**	**0**	**11,0**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV + EF 1.1.1	
F-01	Prayer Room M	718	601	5	188			10%	**500**	139	**1 050**	291	**550**	153	**500**	**0**	**3,1**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-06	Meeting Room (1)	718	601	5	221	500		10%	**550**	153	**1 330**	368	**780**	217	**550**	**0**	**3,5**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-02	Office 2	72	60	5	90	95		10%	**100**	28	**470**	130	**370**	103	**100**	**0**	**0,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-03	Office 3	72	60	5	91	95		10%	**100**	28	**470**	128	**370**	103	**100**	**0**	**0,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-04	Office 4	72	60	5	90	95		10%	**100**	28	**470**	128	**370**	103	**100**	**0**	**0,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-05	Office 5	72	60	5	91	95		10%	**100**	28	**470**	129	**370**	103	**100**	**0**	**0,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-07	Kitchen / Tea Prep. (1)	359	301	5	91	1 512		10%	**300**	83	**870**	241	**0**	0	**970**	**0**	**1,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV + EF 1.1.2	
F-08	Pantry (1)	0	0	5	91			10%	**550**	153	**550**	153	**0**	0	**550**	**0**	**3,5**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-10	Storage Room (1)	0	0	5	72			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-14	Control Room Filing	0	0	5	111	95		10%	**350**	97	**350**	97	**0**	0	**350**	**0**	**2,2**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-15	Control Room Training	144	120	5	167	190		10%	**150**	42	**1 030**	285	**880**	244	**150**	**0**	**1,8**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-13	Control Room	359	301	5	1 833	775		10%	**700**	194	**5 670**	1 573	**4 970**	1 381	**700**	**0**	**9,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-12	Engineering Room	359	301	5	549	475		10%	**600**	167	**3 110**	863	**2 510**	697	**0**	**600**	**5,0**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-11	HVAC Room (1)	0	0	5	120			10%	**600**	167	**4 700**	1 305	**4 100**	1 139	**0**	**600**	**0,0**	**VAV**														**0,0**	AHU 1.1	VAV	
2nd Floor																																			
S-03	Corridor (2) + Stairs	0	0	5	195			10%	**600**	167	**1 660**	461	**1 060**	294	**0**	**600**	**4,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
Total									**9 150**	2 542	**27 330**	7 575	**17 610**	4 892	**6 220**	**3 500**	27 537																		
AHU 1.1 (Office 1)									**9150-9720**		**9150-27330**		**0-17610**		**3 400**				175,5	50,1	**225,6**	14,3	**21,6**	18,3	21,6	17,6		**12,65**		**62,15**	46,7	102,9			
Exhaust Fan (EF 1.1.1)															**1 850**														**0,3**			0,3			
Exhaust Fan (EF 1.1.2)															**400-970**														**0,1**			0,1			
Electrical																	63,7															167,0			
Ground Floor																																			
G-24	Marshalling Room	0	0	5	960	5 000		10%	**600**	167	**3 540**	982	**2 940**	817	**0**	**600**		**VAV**			**11,2**											**4,5**	AHU 1.2	VAV + Split Unit 1.2.1	
G-23	Auxiliary Room	0	0	5	811	5 000		10%	**600**	167	**2 420**	670	**1 820**	506	**0**	**600**		**VAV**			**7,6**											**3,0**	AHU 1.2	VAV + Split Unit 1.2.2	
G-22	Server Room	0	0	5	268	9 740		10%	**600**	167	**3 740**	1 038	**3 140**	872	**0**	**600**		**VAV**			**11,8**											**4,7**	AHU 1.2	VAV + Split Unit 1.2.3	
G-19	UPS Room	0	0	5	668	24 000		10%	**600**	167	**8 770**	2 436	**8 170**	2 269	**0**	**600**		**VAV**			**27,8**											**11,1**	AHU 1.2	VAV + Split Unit 1.2.4	
G-21	Security Equipment Room	0	0	5	121	5 000		10%	**50**	14	**1 680**	466	**1 630**	453	**50**	**0**		**VAV**			**5,3**											**2,1**	AHU 1.2	VAV + Split Unit 1.2.5	
2nd Floor																																			
S-02	Machine Room Lift	0	0	5	186	500		10%	**100**	28	**930**	257	**830**	231	**100**	**0**		**VAV**														**0,0**	AHU 1.2	VAV	
S-01	Drink Water Tanks Room	0	0	5	476	500		10%	**600**	167	**2 740**	760	**2 140**	594	**0**	**600**		**VAV**														**0,0**	AHU 1.2	VAV	
Total									**3 150**	875	**23 820**	6 609	**20 670**	5 742	**150**	**3 000**	21 825																		
AHU 1.2 (Tech)									**3 150**		**23 820**		**0-20670**		**150**				112,6	15,1	**127,7**	14,9	**6,6**	18,3	-	6,6		**11,03**		**28,66**	21,6	62,1			
Electrical																	0,0															62,1			
Ground Floor																																			
G-20	Telecom Room	0	0	5	962	5 000		10%	**600**	167	**11 870**	3 295	**11 270**	3 131	**0**	**600**	**3,8**	**VAV**			**15,7**											**6,3**	AHU 0.2	VAV + Split Unit 0.2.1	
1st Floor																																			
F-16	GSM Room	0	0	5	79	2 000		10%	**50**	14	**3 790**	1 051	**3 740**	1 039	**50**	**0**	**0,3**	**VAV**			**5,0**											**2,0**	AHU 0.2	VAV + Split Unit 0.2.2	
Total									**650**	181	**15 660**	4 346	**15 010**	4 169	**50**	**600**	14 250																		
AHU 0.2 (Telecom)									**650**		**15 660**		**0-15010**		**50**				47,2	4,6	**51,8**	12,3	**15,2**	16,7	2,3	15,2		**7,25**		**2,90**	2,2	28,0			
Electrical																	4,1															32,1			
Ground Floor																																			
G-18	Battery Room	0	0	5	816	500		10%	8 950	2 486	**8 950**	2 486	**0**	0	**8 350**	**600**		**CAV**														**0,0**	AHU 0.3	CAV	
Total									**8 950**	2 486	**8 950**	2 486	**0**	0	**8 350**	**600**	8 950																		
AHU 0.3 (Battery)									**8 950**		**8 950**		**0**		**8 350**				93,9	25,3	**119,2**	17,9	**17,9**	24,8	-	17,9		**4,14**		**72,21**	54,3	65,6			
Exhaust Fan A/B (EF 0.3)															**8 350**														1,9			1,9			ATEX
Electrical																	0,0															67,5			
Fresh Air Fan A/B (FAF 0)									**17800-18280**																							2,5			
Fresh Air Fan A/B (FAF 1)									**12300-12870**																							1,8			
Exhaust Fan A/B (EF 0)															**3 800**														0,5			0,5			
Exhaust Fan A/B (EF 1)															**3 550**														0,5			0,5			
Total									**31 150**	8 361	**91 700**	25 432	**60 550**	16 819	**21 050**	**10 100**					**697**		**81**							**215**		**461**			

Abbreviations:

ACCU	- Air Cooled Condensing Unit
CCU	- Close Control Unit
MAU	- Make-up Air Unit
FAU	- Fresh Air Unit
FCU	- DX Fan Coil Unit
HFCU	- Hydraulic Fan Coil Unit
HC	- Heating Coil
VRF	- Variable Refrigerant Flow (DX outside unit)
HU	- Heating Unit (Aerotherm)
DX	- Direct Expansion
EF	- Exhaust Fan
SF	- Supply Fan
CAV	- Constant Air Volume
VAV	- Variable Air Volume
DEH	- Duct Electric Heater
REH	- Room Electric Heater
AHU	- Air Handling Unit
NC	- Not Controlled
HP	- Heat Pump

HVAC Design Parameter List - Alternativa da Envolvente

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Site Coordinates		
Latitude	Longitude	Altitude
Middle East country		132 m

Outside Design Conditions - Summer: 51,7 °C DB | 28,9 °C WB | 18,7 % RH (1)
Outside Design Conditions - Winter: 4,5 °C DB | 2,0 °C WB | 64,6 % RH (1)

| Room Number | Room Description | Classification | Area [m²] | Height [m] | Height (Average) [m] | Volume [m³] | Openings Perimeter Windows [m] | Openings Perimeter Doors [m] | People [#] | Activity Level | __ to __ Schedule | Room Pressure [Pa] | Temperature (Winter - Summer) [°C] | Relative Humidity (min - max) [%] | Min Supply Temperature [°C] | Minimum Exhaust [m³/h] | Rate Outside air (Occupied spaces) (per person) [m³/h.P] | Rate Outside air (Occupied spaces) (per area) [m³/h.m²] | People density [m²/P] | Occupation [#] | Fresh Air Calculation Standard | Minimum Outside air (for People) [m³/h] | Minimum Air change Rate (for Ventilation Purposes) [1/h] | Minimum Outside air (for Ventilation Purposes) [m³/h] | Minimum Outside air (for overpressure) [m³/h] | Minimum Outside air (for compensating local extracts) [m³/h] | Ventilation Efficiency [%] | Minimum Fresh Air [m³/h] | Supplied Fresh Air [m³/h] | Supplied Fresh Air [l/s] | Resulting Fresh Air Rate [1/h] | Extract Air [m³/h] | Extract Air [l/s] | Overpressure [m³/h] | Overpressure [l/s] | Resulting Fresh Air Rate [1/h] | Cooling Y/N | Heating Y/N | Ventilation Y/N | Humidification Y/N | Dehumidification Y/N | Monitoring of Natural Gases Y/N | Monitoring of Relative Humidity Y/N | Monitoring of Pressure Y/N | EX Y/N | Outside Air gas detection Y/N | Redundant System Y/N | 100% Fresh Air Y/N | Fire Protection [h] | Blast Resistant P/R/N | Air Tight Y/N | Max. Noise Level [NC] | Filter 1 Type | Filter 2 Type | Inertial Sand Filter Y/N | Sand Louvre Y/N | Chemical Filter Y/N |
|---|---|---

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Room Number	Room Description	People Load (Sensible)	People Load (Latent)	Internal Heat load (Lighting)	Internal Heat load (Lighting - 10% for Ballast)	Internal Heat load - Equipment (Sensible) (15)	Internal Heat load - Equipment (Latent)	Safety Factor	Fresh Air (AHU)	Fresh Air (AHU)	Supply Air Flow (AHU)	Supply Air Flow (AHU)	Return Air (AHU)	Return Air (AHU)	Extract Air (Fan)	Overpressure	Reheat Coil Capacity (Electrical)	CAV / VAV	Cooling Power Sensible	Cooling Power Latent	Cooling Power Total	Supply temperature	Heating Power Total (Electrical)	Supply temperature	Heating (Electric)	Dehumidifaction Reheat (Electrical)	Fresh Air Fans Electrical	Supply Fans Electrical	Exhaust Fans Electrical	Humidifier Water	Humidifier Electrical	Electrical	Common Units	Local Units	Remarks
		[W]	[W]	[W/m²]	[W]	[W]	[W]	[%]	[m³/h]	[l/s]	[m³/h]	[l/s]	[m³/h]	[l/s]	[m³/h]	[m³/h]	[kW]		[kW]	[kW]	[kW]	[°C]	[kW]	[°C]	[kW]	[kW]	[kW]	[kW]	[kW]	[kg/h]	[kW]	[kW]			
Control Building																																			
Ground Floor																																			
G-14+G-27	Corridor (0) + Stairs + Personnel Exit	0	0	5	777			10%	**300**	83	**300**	83	**0**	0	**0**	**0**	**1,9**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-29	Lobby (North)	0	0	5	43			10%	**600**	167	**600**	167	**0**	0	**0**	**600**	**3,8**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-28	Lobby (West)	0	0	5	23			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-25	Corridor (SW)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-26	Corridor (SE)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**	**2,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-12	Washroom (Senior Office)	0	0	5	29			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.1	
G-04	Toilet M	0	0	5	91			10%	**650**	181	**650**	181	**0**	0	**750**	**0**	**4,1**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.2	
G-03	Toilet F	0	0	5	89			10%	**600**	167	**600**	167	**0**	0	**700**	**0**	**3,8**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV + EF 0.1.2	
G-06	Dining Room	674	352	5	172			10%	**600**	167	**630**	174	**30**	8	**600**	**0**	**3,8**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-05	Kitchen / Tea Prep. 0	337	176	5	90	1 512		10%	**300**	83	**630**	174	**0**	0	**730**	**0**	**1,9**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV + EF 0.1.3	
G-07	Pantry Room (0)	0	0	5	91			10%	**550**	153	**550**	153	**0**	0	**550**	**0**	**3,5**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-01	Prayer Room F	359	301	5	139			10%	**300**	83	**450**	125	**150**	42	**300**	**0**	**1,9**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-15	Muster Room	718	601	5	343	195		10%	**550**	153	**890**	245	**340**	94	**550**	**0**	**3,5**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-10	Senior Office	144	120	5	188	190		10%	**150**	42	**430**	119	**280**	78	**150**	**0**	**0,9**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-09	Office 1	72	60	5	91	95		10%	**100**	28	**220**	61	**120**	33	**100**	**0**	**0,6**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-08	Meeting Room (0)	1 077	902	5	269	700		10%	**750**	208	**950**	263	**200**	56	**750**	**0**	**4,7**	**VAV**														**0,0**	AHU 0.1	Reheater Coil + VAV	
G-13	Storage (East)	0	0	5	67			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-02	Storage (West)	0	0	5	90			10%	**250**	69	**250**	69	**0**	0	**250**	**0**	**1,6**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
	Storage (Stairs)	0	0	5	45			10%	**150**	42	**150**	42	**0**	0	**150**	**0**	**0,9**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-11	Senior Store	0	0	5	66			10%	**150**	42	**150**	42	**0**	0	**150**	**0**	**0,9**	**CAV**														**0,0**	AHU 0.1	Reheater Coil + CAV	
G-16	HVAC Room (0)	0	0	5	1 092			10%	**600**	167	**1 640**	453	**1 040**	289	**0**	**600**	**0,0**	**VAV**														**0,0**	AHU 0.1	VAV	
Total									**8 200**	2 278	**10 690**	2 961	**2 160**	600	**6 130**	**2 400**	17 690																		
AHU 0.1 (Office 0)									**8200-8530**		**8200-10690**		**0-2160**		**3 750**				96,5	44,0	**140,5**	14,2	**23,2**	13,0	23,2	12,5	**4,95**		**45,25**	34,0	61,1			
Exhaust Fan (EF 0.1.1)															**200**														**0,03**			0,0			
Exhaust Fan (EF 0.1.2)															**1 450**														**0,2**			0,2			
Exhaust Fan (EF 0.1.3)															**400-730**														**0,1**			0,1			
Electrical																	47,9															109,4			
1st Floor																																			
F-18	Corridor (1) + Stairs	0	0	5	714			10%	**1 300**	361	**1 300**	361	**0**	0	**0**	**1 100**	**8,2**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-19	Lobby (Control Room)	0	0	5	48			10%	**600**	167	**600**	167	**0**	0	**0**	**600**	**3,8**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-09	Toilet M	0	0	5	253			10%	**1 750**	486	**1 750**	486	**0**	0	**1 850**	**0**	**11,0**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV + EF 1.1.1	
F-01	Prayer Room M	718	601	5	188			10%	**500**	139	**660**	181	**160**	44	**500**	**0**	**3,1**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-06	Meeting Room (1)	718	601	5	221	500		10%	**550**	153	**860**	238	**310**	86	**550**	**0**	**3,5**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-02	Office 2	72	60	5	90	95		10%	**100**	28	**280**	77	**180**	50	**100**	**0**	**0,6**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-03	Office 3	72	60	5	91	95		10%	**100**	28	**270**	75	**170**	47	**100**	**0**	**0,6**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-04	Office 4	72	60	5	90	95		10%	**100**	28	**270**	75	**170**	47	**100**	**0**	**0,6**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-05	Office 5	72	60	5	91	95		10%	**100**	28	**280**	76	**180**	50	**100**	**0**	**0,6**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-07	Kitchen / Tea Prep. (1)	359	301	5	91	1 512		10%	**300**	83	**670**	186	**0**	0	**770**	**0**	**1,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV + EF 1.1.2	
F-08	Pantry (1)	0	0	5	91			10%	**550**	153	**550**	153	**0**	0	**550**	**0**	**3,5**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-10	Storage Room (1)	0	0	5	72			10%	**200**	56	**200**	56	**0**	0	**200**	**0**	**1,3**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-14	Control Room Filing	0	0	5	111	95		10%	**350**	97	**350**	97	**0**	0	**350**	**0**	**2,2**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
F-15	Control Room Training	144	120	5	167	190		10%	**150**	42	**470**	128	**320**	89	**150**	**0**	**0,9**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-13	Control Room	359	301	5	1 833	775		10%	**700**	194	**3 420**	949	**2 720**	756	**700**	**0**	**4,8**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-12	Engineering Room	359	301	5	549	475		10%	**600**	167	**1 410**	389	**810**	225	**0**	**600**	**4,7**	**VAV**														**0,0**	AHU 1.1	Reheater Coil + VAV	
F-11	HVAC Room (1)	0	0	5	120			10%	**600**	167	**1 680**	464	**1 080**	300	**0**	**600**	**0,0**	**VAV**														**0,0**	AHU 1.1	VAV	
2nd Floor																																			
S-03	Corridor (2) + Stairs	0	0	5	195			10%	**600**	167	**600**	167	**0**	0	**0**	**600**	**3,8**	**CAV**														**0,0**	AHU 1.1	Reheater Coil + CAV	
Total									**9 150**	2 542	**15 620**	4 324	**6 100**	1 694	**6 020**	**3 500**	17 620																		
AHU 1.1 (Office 1)									**9150-9520**		**9150-15620**		**0-6100**		**3 400**				139,9	53,8	**193,7**	13,8	**29,4**	15,0	29,4	15,9	**7,23**		**54,17**	40,7	84,7			
Exhaust Fan (EF 1.1.1)															**1 850**														**0,3**			0,3			
Exhaust Fan (EF 1.1.2)															**400-770**														**0,1**			0,1			
Electrical																	55,1															140,2			
Ground Floor																																			
G-24	Marshalling Room	0	0	5	960	5 000		10%	**600**	167	**2 320**	643	**1 720**	478	**0**	**600**		**VAV**			**7,3**											**2,9**	AHU 1.2	VAV + Split Unit 1.2.1	
G-23	Auxiliary Room	0	0	5	811	5 000		10%	**600**	167	**2 020**	561	**1 420**	394	**0**	**600**		**VAV**			**6,4**											**2,6**	AHU 1.2	VAV + Split Unit 1.2.2	
G-22	Server Room	0	0	5	268	9 740		10%	**600**	167	**3 430**	952	**2 830**	786	**0**	**600**		**VAV**			**10,9**											**4,4**	AHU 1.2	VAV + Split Unit 1.2.3	
G-19	UPS Room	0	0	5	668	24 000		10%	**600**	167	**8 280**	2 298	**7 680**	2 133	**0**	**600**		**VAV**			**26,2**											**10,5**	AHU 1.2	VAV + Split Unit 1.2.4	
G-21	Security Equipment Room	0	0	5	121	5 000		10%	**50**	14	**1 640**	455	**1 590**	442	**50**	**0**		**VAV**			**5,2**											**2,1**	AHU 1.2	VAV + Split Unit 1.2.5	
2nd Floor																																			
S-02	Machine Room Lift	0	0	5	186	500		10%	**100**	28	**520**	142	**420**	117	**100**	**0**		**VAV**														**0,0**	AHU 1.2	VAV	
S-01	Drink Water Tanks Room	0	0	5	476	500		10%	**600**	167	**1 150**	319	**550**	153	**0**	**600**		**VAV**														**0,0**	AHU 1.2	VAV	
Total									**3 150**	875	**19 360**	5 370	**16 210**	4 503	**150**	**3 000**	15 870																		
AHU 1.2 (Tech)									**3 150**		**19 360**		**0-16210**		**150**				96,3	14,9	**111,2**	14,9	**11,0**	15,0	11,0	-	**8,96**		**24,26**	18,2	53,4			
Electrical																	0,0															53,4			
Ground Floor																																			
G-20	Telecom Room	0	0	5	962	5 000		10%	**600**	167	**9 630**	2 674	**9 030**	2 508	**0**	**600**	**3,8**	**VAV**			**12,7**											**5,1**	AHU 0.2	VAV + Split Unit 0.2.1	
1st Floor																																			
F-16	GSM Room	0	0	5	79	2 000		10%	**50**	14	**2 560**	711	**2 510**	697	**50**	**0**	**0,3**	**VAV**			**3,4**											**1,4**	AHU 0.2	VAV + Split Unit 0.2.2	
Total									**650**	181	**12 190**	3 385	**11 540**	3 206	**50**	**600**	14 870																		
AHU 0.2 (Telecom)									**650**		**12 190**		**0-11540**		**50**				38,9	4,0	**42,9**	12,2	**10,8**	16,2	2,3	10,8	**5,64**		**2,88**	2,2	22,8			
Electrical																	4,1															26,9			
Ground Floor																																			
G-18	Battery Room	0	0	5	816	500		10%	8 950	2 486	**8 950**	2 486	**0**	0	**8 350**	**600**		**CAV**														**0,0**	AHU 0.3	CAV	
Total									**8 950**	2 486	**8 950**	2 486	**0**	0	**8 350**	**600**	17 870																		
AHU 0.3 (Battery)									**8 950**		**8 950**		**0**						93,9	25,3	**119,2**	17,9	**19,3**	25,1	-	19,3	**4,14**		**72,19**	54,3	66,1			
Exhaust Fan A/B (EF 0.3)															**8 350**														1,9			1,9			ATEX
Electrical																	0,0															68,1			
Fresh Air Fan A/B (FAF 0)									**17800-18130**																		2,5				2,5			
Fresh Air Fan A/B (FAF 1)									**12300-12670**																		1,8				1,8			
Exhaust Fan A/B (EF 0)															**3 800**														0,5			0,5			
Exhaust Fan A/B (EF 1)															**3 550**														0,5			0,5			
Total									**30 800**	8 361	**66 810**	18 526	**36 010**	10 003	**20 700**	**10 100**					**608**		**94**						**199**			**403**			

Abbreviations:

ACCU	- Air Cooled Condensing Unit
CCU	- Close Control Unit
MAU	- Make-up Air Unit
FAU	- Fresh Air Unit
FCU	- DX Fan Coil Unit
HFCU	- Hydraulic Fan Coil Unit
HC	- Heating Coil
VRF	- Variable Refrigerant Flow (DX outside unit)
HU	- Heating Unit (Aerotherm)
DX	- Direct Expansion
EF	- Exhaust Fan
SF	- Supply Fan
CAV	- Constant Air Volume
VAV	- Variable Air Volume
DEH	- Duct Electric Heater
REH	- Room Electric Heater
AHU	- Air Handling Unit
NC	- Not Controlled
HP	- Heat Pump

HVAC Design Parameter List - Alternativa do Chiller e Bomba de Calor

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Site Coordinates		
Latitude	Longitude	Altitude
Middle East country		132 m

Outside Design Conditions - Summer: 51,7 ° C DB | 28,9 ° C WB | 18,7 % RH (1)
Outside Design Conditions - Winter: 4,5 ° C DB | 2,0 ° C WB | 64,6 % RH (1)

| Room Number | Room Description | Classification | Area [m²] | Height [m] | Height (Average) [m] | Volume [m³] | Openings Perimeter Windows [m] | Openings Perimeter Doors [m] | People [#] | Activity Level | Schedule __ to __ | Room Pressure [Pa] | Temperature (Winter - Summer) [°C] | Relative Humidity (min - max) [%] | Min. Supply Temperature [°C] | Minimum Exhaust [m³/h] | Rate Outside air (for Occupancy) (per person) [m³/h.P] | Rate Outside air (for Occupied spaces) (per area) [m³/h.m²] | People density [m²/P] | Occupation [#] | Fresh Air Calculation Standard | Minimum Outside air (for People) [m³/h] | Minimum Air change Rate (for Ventilation Purposes) [1/h] | Minimum Outside air (for Ventilation Purposes) [m³/h] | Minimum Outside air (for overpressure) [m³/h] | Minimum Outside air (for compensating local extracts) [m³/h] | Ventilation Efficiency [%] | **Minimum Fresh Air** [m³/h] | **Supplied Fresh Air** [m³/h] | Supplied Fresh Air [l/s] | Resulting Fresh Air Rate [1/h] | **Extract Air** [m³/h] | Extract Air [l/s] | **Overpressure** [m³/h] | Overpressure [l/s] | Resulting Fresh Air Rate [1/h] | Cooling Y / N | Heating Y / N | Ventilation Y / N | Humidification Y / N | Dehumidification Y / N | Monitoring of Sick / corrosive gases Y / N | Monitoring of Relative Humidity Y / N | Monitoring of Pressure Y / N | EX Y / N | Outside Air gas detection Y / N | Redundant System Y / N | 100% Fresh Air Y / N | Fire Protection [h] | Blast Resistant/Proof P / R / N | Air Tight Y / N | Max. Noise Level [NC] | Filter 1 Type | Filter 2 Type | Inertial Sand Filter Y / N | Sand Louvre Y / N | Chemical Filter Y / N |
|---|---|---

Doc. No.
Project No:
Project Location:
Project Title:

Client:
Rev.:

Room Number	Room Description	People Load (Sensible) [W]	People Load (Latent) [W]	Internal Heat load (Lighting) [W/m²]	Internal Heat load (Lighting + 10 % for Ballast) [W]	Internal Heat load - Equipment (Sensible) (10) [W]	Internal Heat load - Equipment (Latent) [W]	Safety Factor [%]	**Fresh Air (AHU)** [m³/h]	Fresh Air (AHU) [l/s]	**Supply Air Flow (AHU)** [m³/h]	Supply Air Flow (AHU) [l/s]	**Return Air (AHU)** [m³/h]	Return Air (AHU) [l/s]	**Extract Air (Fan)** [m³/h]	**Overpressure** [m³/h]	**Reheat Coil Capacity (Electrical)** [kW]	**CAV / VAV**	Cooling Power Sensible [kW]	Cooling Power Latent [kW]	**Cooling Power Total** [kW]	Supply temperature [°C]	**Heating Power Total (Electrical)** [kW]	Supply temperature [°C]	Heating (Electric!) [kW]	Dehumidification Reheat (Electrical) [kW]	Fan Coil Fans Electrical [kW]	Fresh Air Fans Electrical [kW]	Supply Fans Electrical [kW]	Exhaust Fans Electrical [kW]	**Humidifier Water** [kg/h]	Humidifier Electrical [kW]	**Electrical** [kW]	Common Units	Local Units	Remarks
Control Building																																					
Ground Floor																																					
G-14+G-27	Corridor (0) + Stairs + Personnel Exit	0	0	5	777			10%	**250**	69	**250**	69	**0**	0	**0**	**0**		**CAV**	0,2	0,0	**0,2**	18,2	**1,0**	32,5			**0,01**							**0,41**	AHU 0.1	FC 0.1.1	
G-29	Lobby (North)	0	0	5	43			10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**																AHU 0.1		
G-28	Lobby (West)	0	0	5	23			10%	**400**	111	**400**	111	**0**	0	**0**	**400**		**CAV**																AHU 0.1		
G-25	Corridor (SW)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**		**CAV**	0,1	0,0	**0,1**	18,9	**1,3**	30,8			**0,01**							**0,53**	AHU 0.1	FC 0.1.2	
G-26	Corridor (SE)	0	0	5	127			10%	**400**	111	**400**	111	**0**	0	**0**	**400**		**CAV**	0,1	0,0	**0,1**	17,2	**0,9**	27,7			**0,01**							**0,37**	AHU 0.1	FC 0.1.3	
G-12	Washroom (Senior Office)	0	0	5	29			10%	**200**	56	**200**	56	**0**	0	**200**	**0**		**CAV**																AHU 0.1		
G-04	Toilet M	0	0	5	91			10%	**650**	181	**650**	181	**0**	0	**750**	**0**		**CAV**					**0,1**	21,5			**0,02**							**0,06**	AHU 0.1	FC 0.1.4 + EF 0.1.2	
G-03	Toilet F	0	0	5	89			10%	**600**	167	**600**	167	**0**	0	**700**	**0**		**CAV**					**0,1**	21,6			**0,02**							**0,06**	AHU 0.1	FC 0.1.5 + EF 0.1.2	
G-06	Dining Room	674	352	5	172			10%	**600**	167	**600**	167	**600**	167	**0**	**0**		**CAV**	1,4	0,2	**1,6**	16,5	**0,4**	23,1			**0,02**							**0,66**	AHU 0.1	FC 0.1.6	
G-05	Kitchen / Tea Prep. 0	337	176	5	90	1 512		10%	**300**	83	**300**	83	**0**	0	**400**	**0**		**CAV**	1,5	0,4	**1,9**	13,8	**0,2**	22,2			**0,02**							**0,78**	AHU 0.1	FC 0.1.7 + EF 0.1.2	
G-07	Pantry Room (0)	0	0	5	91			10%	**550**	153	**550**	153	**550**	153	**0**	**0**		**CAV**	0,3	0,0	**0,3**	17,9	**0,1**	21,5			**0,02**							**0,14**	AHU 0.1	FC 0.1.8	
G-01	Prayer Room F	359	301	5	139			10%	**300**	83	**300**	83	**300**	83	**0**	**0**		**CAV**	0,9	0,3	**1,2**	14,9	**0,4**	24,9			**0,01**							**0,49**	AHU 0.1	FC 0.1.9	
G-15	Muster Room	718	601	5	343	195		10%	**550**	153	**550**	153	**550**	153	**0**	**0**		**CAV**	1,9	0,5	**2,4**	14,5	**0,9**	25,3			**0,02**							**0,98**	AHU 0.1	FC 0.1.10	
G-10	Senior Office	144	120	5	188	190		10%	**150**	42	**150**	42	**150**	42	**0**	**0**		**CAV**	0,8	0,2	**1,0**	14,7	**0,4**	25,2			**0,01**							**0,41**	AHU 0.1	FC 0.1.11	
G-09	Office 1	72	60	5	91	95		10%	**100**	28	**100**	28	**100**	28	**0**	**0**		**CAV**	0,4	0,1	**0,5**	14,7	**0,2**	25,1			**0,01**							**0,21**	AHU 0.1	FC 0.1.12	
G-08	Meeting Room (0)	1 077	902	5	269	700		10%	**750**	208	**750**	208	**750**	208	**0**	**0**		**CAV**	2,2	0,7	**2,9**	17,8	**0,5**	25,1			**0,03**							**1,19**	AHU 0.1	FC 0.1.13	
G-13	Storage (East)	0	0	5	67			10%	**200**	56	**200**	56	**200**	56	**0**	**0**		**CAV**																AHU 0.1		
G-02	Storage (West)	0	0	5	90			10%	**250**	69	**250**	69	**250**	69	**0**	**0**		**CAV**																AHU 0.1		
-	Storage (Stairs)	0	0	5	45			10%	**150**	42	**150**	42	**150**	42	**0**	**0**		**CAV**																AHU 0.1		
G-11	Senior Store	0	0	5	66			10%	**150**	42	**150**	42	**150**	42	**0**	**0**		**CAV**					**0,1**	23,7			**0,01**							**0,05**	AHU 0.1	FC 0.1.14	
G-20	Telecom Room	0	0	5	962	5 000		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	12,7	1,1	**13,8**	12,8					**0,21**							**5,73**	AHU 0.2	FC 0.1.15 + Split Unit 0.1.1	
G-16	HVAC Room (0)	0	0	5	1 092			10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	3,4	0,3	**3,7**	15,9					**0,04**							**1,52**	AHU 0.1	FC 0.1.16	
2nd Floor																																					
F-16	GSM Room	0	0	5	79	2 000		10%	**50**	14	**50**	14	**50**	14	**0**	**0**		**CAV**	3,2	0,1	**3,3**	12,5					**0,05**							**1,37**	AHU 0.1	FC 0.1.17 + Split Unit 0.1.2	
Total									**8 800**	2 444	**8 800**	2 444	**3 800**	1 056	**2 050**	**3 000**	6,6				**33,0**		**6,6**				**0,5**							15,0			
FAHU 0.1 (Office 0)									**8 800**		**8 800**		**3 800**			**1 403**			93,1	30,1	**123,2**	15,8	**35,9**	19,6	35,9	11,5			**4,07**	**0,88**	**42,20**	31,7	54,2			
Exhaust Fan (EF 0.1.1)															**200**															**0,03**			0,0			
Exhaust Fan (EF 0.1.2)															**1 450**															**0,2**			0,2			
Exhaust Fan (EF 0.1.3)															**400**															**0,1**			0,1			
Electrical																	0,0																	**69,5**			
1st Floor																																					
F-18	Corridor (1) + Stairs	0	0	5	714			10%	**1 300**	361	**1 300**	361	**0**	0	**0**	**1 100**		**CAV**	0,2	0,0	**0,2**	18,7	**1,9**	25,4			**0,05**							**0,81**	AHU 1.1	FC 1.1.1	
F-19	Lobby (Control Room)	0	0	5	48			10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**									**0,02**							**0,02**	AHU 1.1		
F-09	Toilet M	0	0	5	253			10%	**1 750**	486	**1 750**	486	**0**	0	**1 850**	**0**		**CAV**					**0,3**	21,7			**0,06**							**0,18**	AHU 1.1	FC 1.1.2 + EF 1.1.1	
F-01	Prayer Room M	718	601	5	188			10%	**500**	139	**500**	139	**500**	139	**0**	**0**		**CAV**	1,3	0,4	**1,7**	15,6	**0,4**	23,5			**0,02**							**0,70**	AHU 1.1	FC 1.1.3	
F-06	Meeting Room (1)	718	601	5	221	500		10%	**550**	153	**550**	153	**550**	153	**0**	**0**		**CAV**	1,7	0,6	**2,3**	14,6	**0,5**	23,8			**0,02**							**0,94**	AHU 1.1	FC 1.1.4	
F-02	Office 2	72	60	5	90	95		10%	**100**	28	**100**	28	**100**	28	**0**	**0**		**CAV**	0,5	0,1	**0,6**	14,9	**0,3**	25,3			**0,01**							**0,25**	AHU 1.1	FC 1.1.5	
F-03	Office 3	72	60	5	91	95		10%	**100**	28	**100**	28	**100**	28	**0**	**0**		**CAV**	0,5	0,1	**0,6**	14,9	**0,3**	25,4			**0,01**							**0,25**	AHU 1.1	FC 1.1.6	
F-04	Office 4	72	60	5	90	95		10%	**100**	28	**100**	28	**100**	28	**0**	**0**		**CAV**	0,5	0,1	**0,6**	14,9	**0,3**	25,3			**0,01**							**0,25**	AHU 1.1	FC 1.1.7	
F-05	Office 5	72	60	5	91	95		10%	**100**	28	**100**	28	**100**	28	**0**	**0**		**CAV**	0,5	0,1	**0,6**	14,9	**0,3**	25,3			**0,01**							**0,25**	AHU 1.1	FC 1.1.8	
F-07	Kitchen / Tea Prep. (1)	359	301	5	91	1 512		10%	**300**	83	**300**	83	**0**	0	**400**	**0**		**CAV**	1,5	0,4	**1,9**	13,9	**0,2**	22,5			**0,02**							**0,78**	AHU 1.1	FC 1.1.9 + EF 1.1.2	
F-08	Pantry (1)	0	0	5	91			10%	**550**	153	**550**	153	**550**	153	**0**	**0**		**CAV**	0,4	0,0	**0,4**	17,7	**0,1**	21,8			**0,02**							**0,18**	AHU 1.1	FC 1.1.10	
F-10	Storage Room (1)	0	0	5	72			10%	**200**	56	**200**	56	**200**	56	**0**	**0**		**CAV**					**0,2**	23,5			**0,01**							**0,09**	AHU 1.1	FC 1.1.11	
F-14	Control Room Filing	0	0	5	111	95		10%	**350**	97	**350**	97	**350**	97	**0**	**0**		**CAV**					**0,2**	23,5			**0,01**							**0,09**	AHU 1.1	FC 1.1.12	
F-15	Control Room Training	144	120	5	167	190		10%	**150**	42	**150**	42	**150**	42	**0**	**0**		**CAV**	0,9	0,1	**1,0**	15,1	**0,5**	25,3			**0,01**							**0,41**	AHU 1.1	FC 1.1.13	
F-13	Control Room	359	301	5	1 833	775		10%	**700**	194	**700**	194	**700**	194	**0**	**0**		**CAV**	6,3	0,8	**7,1**	14,6	**3,6**	25,8			**0,08**							**2,92**	AHU 1.1	FC 1.1.14	
F-12	Engineering Room	359	301	5	549	475		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	2,7	0,4	**3,1**	14,9	**1,5**	25,6			**0,03**							**1,27**	AHU 1.1	FC 1.1.15	
F-11	HVAC Room (1)	0	0	5	120			10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	3,0	0,3	**3,3**	15,2					**0,03**							**1,35**	AHU 1.1	FC 1.1.16	
2nd Floor																																					
S-03	Corridor (2) + Stairs	0	0	5	195			10%	**500**	139	**500**	139	**0**	0	**0**	**600**		**CAV**	0,9	0,0	**0,9**	17,3	**1,5**	29,9			**0,02**							**0,62**	AHU 1.1	FC 1.1.17	
Total									**9 050**	2 514	**9 050**	2 514	**3 400**	944	**2 250**	**3 500**	9,45				**24,3**		**12,1**				**0,4**							11,3			
FAHU 1.1 (Office 1)									**9 050**		**9 050**		**3 400**						99,7	31,4	**131,1**	15,8	**39,2**	19,6	39,2	11,8			**4,19**	**0,79**	**43,39**	32,6	57,4			
Exhaust Fan (EF 1.1.1)															**1 850**															**0,3**			0,3			
Exhaust Fan (EF 1.1.2)															**400**															**0,1**			0,1			
Electrical																	0,0																	**69,1**			
Ground Floor																																					
G-24	Marshalling Room	0	0	5	960	5 000		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	6,9	1,1	**8,0**	13,6					**0,07**							**3,27**	AHU 1.2	FC 1.2.1 + Split Unit 1.2.1	
G-23	Auxiliary Room	0	0	5	811	5 000		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	6,4	1,1	**7,5**	13,5					**0,06**							**3,06**	AHU 1.2	FC 1.2.2 + Split Unit 1.2.2	
G-22	Server Room	0	0	5	268	9 740		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	10,8	1,3	**12,1**	13,1					**0,10**							**4,94**	AHU 1.2	FC 1.2.3 + Split Unit 1.2.3	
G-19	UPS Room	0	0	5	668	24 000		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	25,9	1,6	**27,5**	12,7					**0,23**							**11,23**	AHU 1.2	FC 1.2.4 + Split Unit 1.2.4	
G-21	Security Equipment Room	0	0	5	121	5 000		10%	**50**	14	**50**	14	**0**	0	**0**	**0**		**CAV**	5,2	0,1	**5,3**	12,5					**0,05**							**2,17**	AHU 1.2	FC 1.2.5 + Split Unit 1.2.5	
G-18	Battery Room	0	0	5	816	500		10%	8 950	2 486	**8 950**	2 486	**0**	0	**8 350**	**600**		**CAV**	2,1	0,0	**2,1**	17,1					**0,31**							**1,15**	AHU 1.2	FC 1.2.6	ATEX
2nd Floor																																**0,00**					
S-02	Machine Room Lift	0	0	5	186	500		10%	**100**	28	**100**	28	**0**	0	**0**	**0**		**CAV**	1,2	0,2	**1,4**	14,9					**0,01**							**0,57**	AHU 1.2	FC 1.2.7	
S-01	Drink Water Tanks Room	0	0	5	476	500		10%	**600**	167	**600**	167	**0**	0	**0**	**600**		**CAV**	2,4	0,3	**2,7**	16,2					**0,03**							**1,11**	AHU 1.2	FC 1.2.8	
Total									**12 100**	3 361	**12 100**	3 361	**0**	0	**8 350**	**3 600**	14,95				**66,6**						**0,9**							27,5			
FAHU 1.2 (Tech)									**12 100**		**12 100**		**0**		**0**				141,5	37,4	**178,9**	17,4	**32,7**	12,6	32,7	-			**5,60**		**22,76**	17,1	77,2			
Exhaust Fan A/B (EF 1.2)															**8 350**															1,9			1,9		ATEX	
Electrical																	0,0																	**106,6**			
Total									**29 950**	**8 319**	**29 950**	**8 319**	**7 200**	**2 000**	**12 650**	**10 100**					**557**		**127**									**108**		**245**			

Abbreviations:

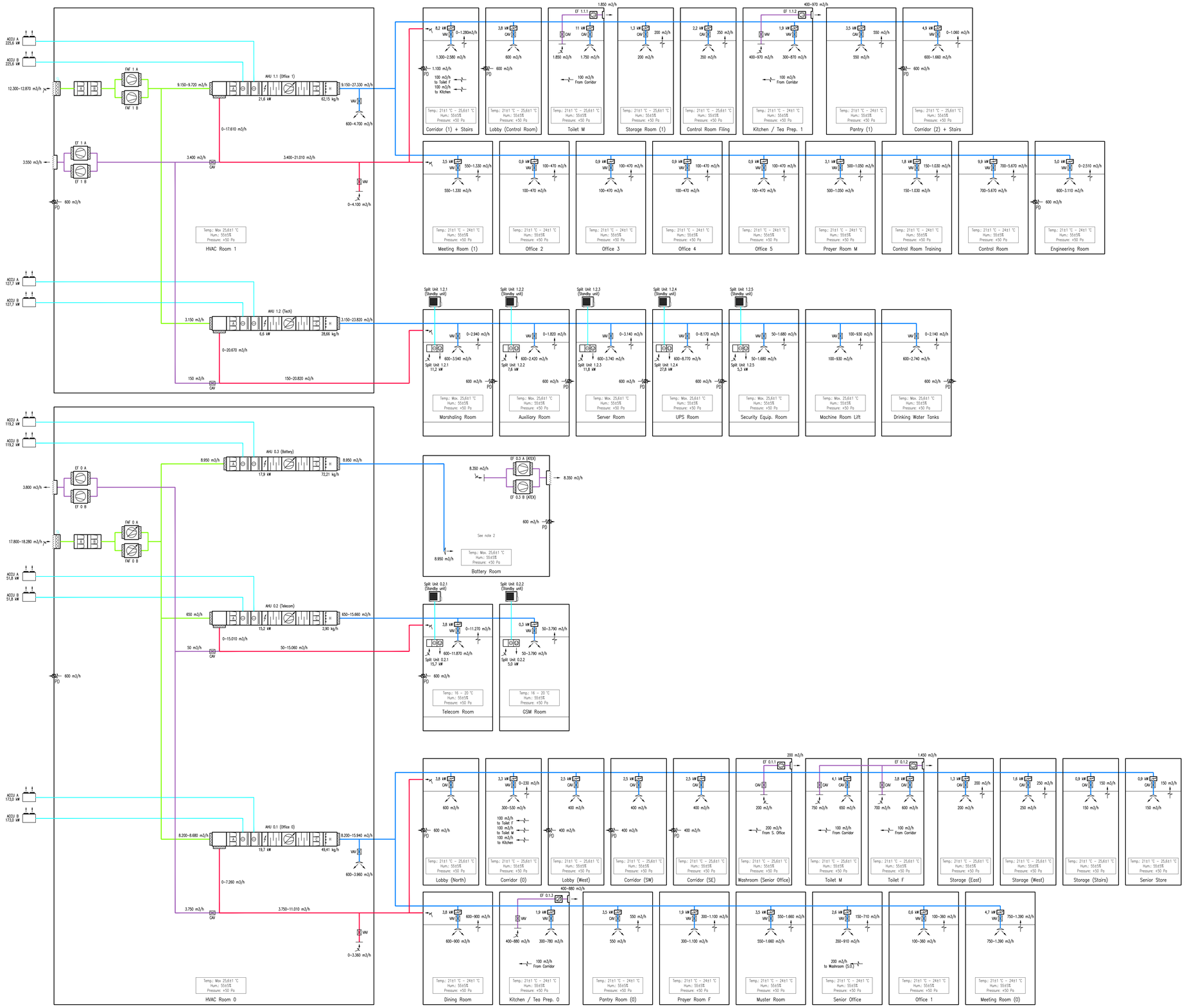
ACCU	- Air Cooled Condensing Unit
CCU	- Close Control Unit
MAU	- Make-up Air Unit
FAU	- Fresh Air Unit
FCU	- DX Fan Coil Unit
HFCU	- Hydraulic Fan Coil Unit
HC	- Heating Coil
VRF	- Variable Refrigerant Flow (DX outside unit)
HU	- Heating Unit (Aerotherm)
DX	- Direct Expansion
EF	- Exhaust Fan
SF	- Supply Fan
CAV	- Constant Air Volume
VAV	- Variable Air Volume
DEH	- Duct Electric Heater
REH	- Room Electric Heater
AHU	- Air Handling Unit
NC	- Not Controlled
HP	- Heat Pump

Anexo VI

Process Flow Diagrams

Diagramas que fazem parte do projecto original (excepto alternativas HVAC e IPS) e que representam graficamente os espaços do edifício, os equipamentos de AVAC, os requisitos dos espaços, os fluxos de ar e fluídos e as configurações dos vários sistemas de AVAC. Por motivos de confidencialidade, estes desenhos foram editados para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

1 PFD – Original
2 PFD – Alternativa Envolvente
3 PFD – Alternativa Chiller e Bomba de Calor

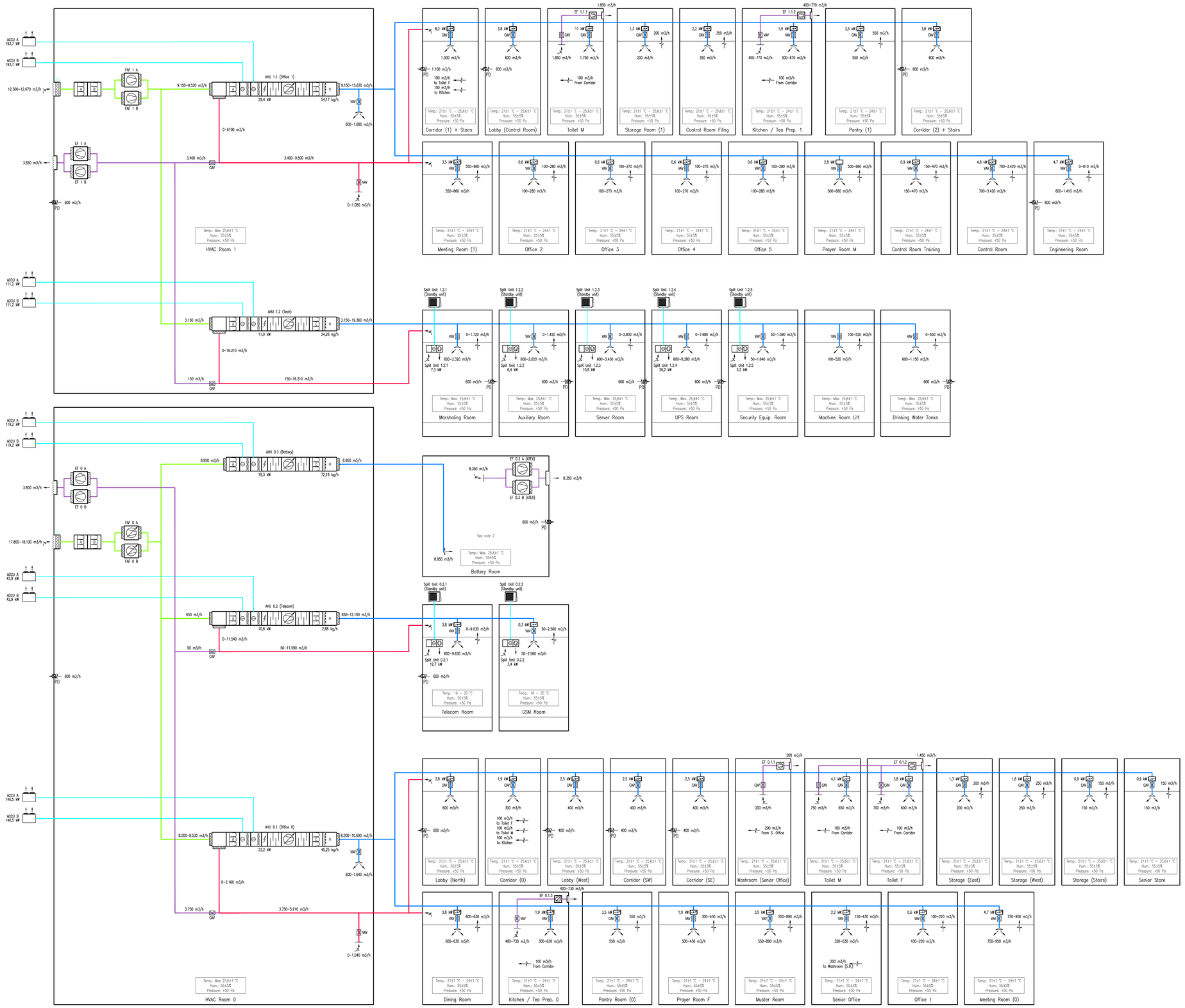


1. HVAC design based on XXX standards:
   - XXX
   - XXX
2. Battery Room
   - XXX + Fan motor shall be explosion proof, suitable for ambient temperature of 50 °C, EExd Zone-1,Group IIC (Hydrogen), T3 classification and suitable for electrical 'power supply as specified in the project document. Open batteries type to be used with H2 detection.
   - Flow for the room to be confirmed when battery information is available.

SYMBOLS:

- AIR DUCT – FRESH AIR
- AIR DUCT – EXHAUST
- AIR DUCT – SUPPLY
- AIR DUCT – RETURN
- REFRIGERANT PIPING
- WATER PIPING (X2) – COOLING
- WATER PIPING (X2) – HEATING
- CAV – CONSTANT AIR VOLUME DAMPER
- VAV – VARIABLE AIR VOLUME DAMPER
- PD – PRESSURE DAMPER
- SL – SAND LOUVER
- EF – EXHAUST FAN
- FAF – FRESH AIR FAN
- AHU – AIR HANDLING UNIT
- ACCU – AIR COOLED CONDENSING UNIT
- A/B – 100% REDUNDANT UNITS
- nnn m3/h From Corridor – AIR TRANSFER THROUGH DOOR GAPS

PFD - Original



1. HVAC design based on XXX standards:
   - XXX
   - XXX
2. Battery Room
   - XXX + Fan motor shall be explosion proof, suitable for ambient temperature of 50 °C, EExd Zone-1,Group IIC (Hydrogen), T3 classification and suitable for electrical 'power supply as specified in the project document. Open batteries type to be used with H2 detection.
   - Flow for the room to be confirmed when battery information is available.

SYMBOLS:

- AIR DUCT – FRESH AIR
- AIR DUCT – EXHAUST
- AIR DUCT – SUPPLY
- AIR DUCT – RETURN
- REFRIGERANT PIPING
- WATER PIPING (X2) – COOLING
- WATER PIPING (X2) – HEATING
- CAV – CONSTANT AIR VOLUME DAMPER
- VAV – VARIABLE AIR VOLUME DAMPER
- PD – PRESSURE DAMPER
- SL – SAND LOUVER
- EF – EXHAUST FAN
- FAF – FRESH AIR FAN
- AHU – AIR HANDLING UNIT
- ACCU – AIR COOLED CONDENSING UNIT
- A/B – 100% REDUNDANT UNITS
- nnn m3/h From Corridor – AIR TRANSFER THROUGH DOOR GAPS

PFD - Alternativa da Envolvente

A0

1. HVAC design based on XXX standards:
   - XXX
   - XXX
2. Battery Room
   - XXX = Fan motor shall be explosion proof, suitable for ambient temperature of 50 °C, EExd Zone-1,Group IIC (Hydrogen), T3 classification and suitable for electrical 'power supply as specified in the project document. Open batteries type to be used with H2 detection.
   - Flow for the room to be confirmed when battery information is available.

SYMBOLS:

- AIR DUCT - FRESH AIR
- AIR DUCT - EXHAUST
- AIR DUCT - SUPPLY
- AIR DUCT - RETURN
- REFRIGERANT PIPING
- WATER PIPING (XZ) - COOLING
- WATER PIPING (XZ) - HEATING
- CAV - CONSTANT AIR VOLUME DAMPER
- VAV - VARIABLE AIR VOLUME DAMPER
- PD - PRESSURE DAMPER
- SL - SAND LOUVER
- EF - EXHAUST FAN
- FAF - FRESH AIR FAN
- AHU - AIR HANDLING UNIT
- ACCU - AIR COOLED CONDENSING UNIT
- A/B - 100% REDUNDANT UNITS
- nnn m3/h From Corridor - AIR TRANSFER THROUGH DOOR GAPS

PFD - Alternativa
Chiller e Bomba de Calor

A0

Anexo VII

HAP Calculations - Inputs

Relatórios com a informação introduzida no programa HAP 6.2. Por motivos de confidencialidade, estes relatórios foram editados para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

1 Weather Reports
2 Building Input – Original + Alternativa Envolvente
3 Building Input – Alternativa Chiller e Bomba de Calor
4 Space Model Inputs - Original
5 Space Model Inputs – Alternativa Envolvente
6 Space Model Inputs - Alternativa Chiller e Bomba de Calor
7 Air System Inputs – Original
8 Air System Inputs - Alternativa Envolvente
9 Air System Inputs - Alternativa Chiller e Bomba de Calor
10 Plant Inputs - Alternativa Chiller e Bomba de Calor
11 Alternative Inputs - Original
12 Alternative Inputs – Alternativa Envolvente
13 Alternative Inputs - Alternativa Chiller e Bomba de Calor
14 Schedule Inputs
15 Wall Inputs
16 Roof Inputs
17 Ceiling Inputs
18 Floor Inputs
19 Window Inputs
20 Door Inputs
21 Chiller e Bomba de Calor Inputs
22 Electric Rate Inputs

Design Weather Parameters

Project: Calculations 10-05-2025
Prepared by: IPS 11:42

Design Parameters:

Location	**Middle East**	
Latitude	**[redacted]**	°N (+ : north, - : south)
Longitude	**[redacted]**	°E (+ : east, - : west)
Elevation	**132,0**	m
Climate Zone	**0B - Extremely Hot Dry**	
Local Time Zone	**3,0**	hours from GMT (+ : east, - : west)
Summer Design Condition	**User Defined**	
Summer Coincident Dry-Bulb	**51,7**	C
Summer Design Wet-Bulb	**28,9**	C
Summer Daily Range	**13,3**	K
Hottest Month	**July**	
Winter Design Condition	**User Defined**	
Winter Design Dry-Bulb	**4,5**	C
Winter Design Wet-Bulb	**2,0**	C
Outdoor Air CO2 Level	**400**	ppm
Average Ground Reflectance	**0,20**	
Soil Conductivity	**1,385**	W/(m K)
Design Cooling Months	**January to December**	
Consider Daylight Savings Time	**Não**	
Simulation Weather Data	**[redacted])**	
Current Data is	**User Defined**	

Design Day Maximum Solar Fluxes

(The flux values are expressed in W/sqm)

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	110,2	110,2	131,2	321,2	498,9	649,9	719,1	751,4	745,2
February	130,5	130,5	225,2	414,2	560,1	680,6	713,9	706,2	682,9
March	152,2	156,5	331,6	507,4	622,9	673,1	671,9	614,8	571,8
April	171,2	267,3	419,9	554,7	625,6	622,0	561,8	466,7	415,5
May	175,1	346,0	484,3	584,3	620,6	583,9	479,6	362,9	298,8
June	205,6	382,6	519,3	610,3	631,4	576,8	454,6	320,4	247,8
July	175,6	347,6	493,5	596,9	629,3	585,9	481,2	354,8	288,3
August	155,5	270,6	431,3	573,6	646,7	639,4	569,8	465,4	407,6
September	140,9	152,7	332,3	502,5	631,0	679,6	664,9	601,5	564,5
October	129,3	129,3	209,1	388,9	548,5	639,3	693,1	681,4	667,9
November	113,8	113,8	120,8	304,9	471,5	607,6	692,6	721,1	721,7
December	104,6	104,6	104,6	280,7	448,6	613,1	697,5	744,9	748,7

Month	SSW	SW	WSW	W	WNW	NW	NNW	HOR	Mult
January	751,4	719,2	649,9	499,1	321,0	131,3	110,2	637,4	1,00
February	707,1	717,5	678,1	562,4	416,6	220,8	130,5	758,5	1,00
March	615,1	671,1	677,2	618,3	507,1	335,2	154,3	871,8	1,00
April	471,3	564,8	620,2	615,7	556,5	432,0	260,9	932,0	1,00
May	365,7	487,7	574,4	617,3	591,4	495,2	343,5	957,5	1,00
June	321,2	459,5	571,0	633,0	617,9	528,2	377,4	972,7	1,00
July	357,4	484,3	582,2	629,1	599,8	498,7	342,2	955,5	1,00
August	468,8	573,3	629,2	644,1	578,2	441,5	263,6	934,6	1,00
September	605,0	663,0	682,8	616,0	506,2	340,3	142,9	864,1	1,00
October	678,5	691,2	645,9	548,6	382,9	213,5	129,3	734,6	1,00
November	718,9	694,3	598,7	477,5	299,6	128,2	113,8	621,8	1,00
December	739,8	706,6	604,0	464,3	266,0	104,6	104,6	584,8	1,00

Mult. = User-defined solar multiplier factor.

Cooling Design Temperature Profiles

Project: Calculations 10-05-2025
Prepared by: IPS 11:42

Location: Middle East

(Dry and Wet Bulb temperatures are expressed in C)

Hr	January		February		March		April		May		June	
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB
0000	16,9	8,8	18,6	12,0	24,7	17,7	30,3	20,2	35,8	23,3	39,1	25,2
0100	16,1	8,4	17,8	11,6	23,9	17,4	29,5	20,0	35,0	23,1	38,3	25,0
0200	15,6	8,1	17,3	11,4	23,4	17,3	28,9	19,8	34,5	23,0	37,8	24,9
0300	15,2	7,9	16,9	11,3	23,0	17,1	28,5	19,7	34,1	22,9	37,4	24,8
0400	14,8	7,8	16,5	11,1	22,6	17,0	28,1	19,6	33,7	22,8	37,0	24,7
0500	14,5	7,6	16,2	11,0	22,3	16,9	27,9	19,5	33,4	22,7	36,7	24,6
0600	14,8	7,8	16,5	11,1	22,6	17,0	28,1	19,6	33,7	22,8	37,0	24,7
0700	15,7	8,2	17,4	11,5	23,5	17,3	29,1	19,9	34,6	23,0	37,9	24,9
0800	18,0	9,2	19,7	12,4	25,8	18,1	31,3	20,6	36,9	23,6	40,2	25,5
0900	20,5	10,4	22,2	13,4	28,3	18,9	33,8	21,3	39,4	24,3	42,7	26,1
1000	22,8	11,3	24,5	14,3	30,6	19,6	36,1	22,0	41,7	24,9	45,0	26,6
1100	24,8	12,1	26,4	15,0	32,6	20,2	38,1	22,5	43,6	25,4	47,0	27,1
1200	26,1	12,7	27,8	15,5	33,9	20,6	39,4	22,9	45,0	25,7	48,3	27,4
1300	27,2	13,1	28,8	15,9	34,9	20,9	40,5	23,2	46,0	26,0	49,4	27,6
1400	27,8	13,4	29,5	16,1	35,6	21,1	41,2	23,3	46,7	26,1	50,0	27,8
1500	27,8	13,4	29,5	16,1	35,6	21,1	41,2	23,3	46,7	26,1	50,0	27,8
1600	27,0	13,0	28,7	15,9	34,8	20,9	40,4	23,1	45,9	25,9	49,2	27,6
1700	26,0	12,6	27,6	15,5	33,7	20,6	39,3	22,9	44,8	25,7	48,2	27,4
1800	24,7	12,1	26,3	15,0	32,4	20,2	38,0	22,5	43,5	25,3	46,8	27,1
1900	22,7	11,3	24,3	14,2	30,4	19,6	36,0	21,9	41,5	24,9	44,8	26,6
2000	21,2	10,6	22,9	13,7	29,0	19,1	34,5	21,5	40,1	24,5	43,4	26,2
2100	20,0	10,1	21,7	13,2	27,8	18,7	33,3	21,1	38,9	24,2	42,2	26,0
2200	18,8	9,6	20,5	12,7	26,6	18,3	32,1	20,8	37,7	23,8	41,0	25,7
2300	17,9	9,2	19,5	12,4	25,6	18,0	31,2	20,5	36,7	23,6	40,1	25,4

Hr	July		August		September		October		November		December	
	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB	DB	WB
0000	40,8	26,4	40,8	26,4	38,0	24,6	31,9	21,5	26,9	17,7	19,7	12,0
0100	40,0	26,2	40,0	26,2	37,2	24,4	31,1	21,3	26,1	17,5	18,9	11,7
0200	39,5	26,1	39,5	26,1	36,7	24,2	30,6	21,1	25,6	17,3	18,4	11,4
0300	39,1	26,0	39,1	26,0	36,3	24,1	30,2	21,0	25,2	17,1	18,0	11,3
0400	38,7	25,9	38,7	25,9	35,9	24,0	29,8	20,9	24,8	17,0	17,6	11,1
0500	38,4	25,9	38,4	25,9	35,6	24,0	29,5	20,8	24,5	16,9	17,3	11,0
0600	38,7	25,9	38,7	25,9	35,9	24,0	29,8	20,9	24,8	17,0	17,6	11,1
0700	39,6	26,1	39,6	26,1	36,8	24,3	30,7	21,1	25,7	17,3	18,5	11,5
0800	41,9	26,7	41,9	26,7	39,1	24,9	33,0	21,8	28,0	18,1	20,8	12,4
0900	44,4	27,3	44,4	27,3	41,6	25,5	35,5	22,5	30,5	18,9	23,3	13,4
1000	46,6	27,8	46,6	27,8	43,9	26,0	37,8	23,1	32,8	19,6	25,6	14,3
1100	48,6	28,2	48,6	28,2	45,9	26,5	39,8	23,7	34,8	20,2	27,6	15,0
1200	50,0	28,5	50,0	28,5	47,2	26,8	41,1	24,0	36,1	20,6	28,9	15,5
1300	51,0	28,8	51,0	28,8	48,3	27,1	42,2	24,3	37,2	20,9	30,0	15,9
1400	51,7	28,9	51,7	28,9	48,9	27,2	42,8	24,5	37,8	21,1	30,6	16,1
1500	51,7	28,9	51,7	28,9	48,9	27,2	42,8	24,5	37,8	21,1	30,6	16,1
1600	50,9	28,7	50,9	28,7	48,1	27,1	42,0	24,3	37,0	20,9	29,8	15,9
1700	49,8	28,5	49,8	28,5	47,1	26,8	41,0	24,0	36,0	20,6	28,8	15,5
1800	48,5	28,2	48,5	28,2	45,7	26,5	39,6	23,6	34,6	20,2	27,4	15,0
1900	46,5	27,8	46,5	27,8	43,7	26,0	37,6	23,1	32,6	19,6	25,4	14,2
2000	45,1	27,4	45,1	27,4	42,3	25,7	36,2	22,7	31,2	19,1	24,0	13,7
2100	43,9	27,1	43,9	27,1	41,1	25,4	35,0	22,4	30,0	18,7	22,8	13,2
2200	42,7	26,9	42,7	26,9	39,9	25,1	33,8	22,0	28,8	18,3	21,6	12,7
2300	41,7	26,7	41,7	26,7	39,0	24,8	32,9	21,8	27,9	18,0	20,6	12,4

Simulation Weather Summary for Salem AB (TMYx_2004_2018)

Project: Calculations 10-05-2025
Prepared by: IPS 11:42

Table 1. Descriptive Parameters:

Location	**Salem AB**	
Latitude	**29,35**	°N (+ : north, - : south)
Longitude	**47,52**	°E (+ : east, - : west)
Elevation	**143,9**	m
Local Time Zone	**3,0**	hours from GMT (+ : east, - : west)

Table 2. Dry-Bulb Temperature Statistics (C):

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum
January	25,0	18,6	13,6	9,1	2,0
February	28,0	23,0	17,1	11,8	8,0
March	35,0	27,8	21,5	15,7	8,0
April	38,0	32,3	26,4	20,1	15,0
May	45,0	38,5	32,7	26,2	19,0
June	48,0	44,4	37,8	29,8	26,0
July	49,0	45,8	39,0	31,4	28,0
August	50,0	46,0	38,9	30,6	27,0
September	46,0	42,4	35,4	27,8	24,0
October	41,0	35,1	28,9	22,9	15,0
November	32,0	24,9	19,8	15,5	12,0
December	28,0	18,6	13,1	8,0	2,0

Table 3. Daily Solar Radiation Statistics:

	Daily Total Solar on Horizontal (kJ/sqm)			Daily Clearness Number (dimensionless)		
Month	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**
January	15468,2	12262,2	5168,8	0,660	0,564	0,225
February	19968,9	16446,4	8878,1	0,696	0,629	0,337
March	24779,1	19894,8	9521,1	0,722	0,625	0,292
April	28170,9	22725,7	8404,3	0,734	0,615	0,229
May	29536,2	24424,5	11264,0	0,724	0,610	0,289
June	29845,8	28924,0	22640,6	0,725	0,703	0,553
July	29601,3	28451,9	25376,0	0,722	0,703	0,618
August	28294,5	27054,5	24353,0	0,716	0,712	0,623
September	25738,1	23655,8	20831,2	0,716	0,706	0,647
October	21466,0	19111,0	16262,1	0,700	0,689	0,652
November	16836,9	14182,8	8901,9	0,680	0,626	0,403
December	14073,4	13462,3	12105,1	0,676	0,662	0,598

Table 4. Time of Occurrence for Maximums and Minimums:

Month	Highest Dry-Bulb Temperature	Lowest Dry-Bulb Temperature	Maximum Total Solar	Minimum Total Solar
January	Jan 24, 1500	Jan 12, 0600	Jan 30	Jan 27
February	Feb 10, 1400	Feb 4, 0500	Feb 28	Feb 16
March	Mar 15, 1200	Mar 8, 0700	Mar 29	Mar 20
April	Apr 17, 1400	Apr 26, 0500	Apr 26	Apr 13
May	May 29, 1400	May 2, 1200	May 28	May 2
June	Jun 18, 1300	Jun 5, 0500	Jun 16	Jun 2
July	Jul 13, 1200	Jul 3, 0500	Jul 4	Jul 1
August	Aug 3, 1500	Aug 29, 0500	Aug 1	Aug 6
September	Sep 5, 1300	Sep 17, 0400	Sep 1	Sep 23
October	Oct 3, 1400	Oct 23, 0400	Oct 1	Oct 31
November	Nov 8, 1200	Nov 16, 0400	Nov 1	Nov 19
December	Dec 5, 1300	Dec 23, 0200	Dec 2	Dec 13

Table 5. Calendar Data:

Day of Week for January 1st ..... **Wednesday**

Holidays:

Jan	1	30				
Feb	25	26				
Mar	30	31				
Apr	1					
Jun	5	6	7	8	9	26
Sep	4					

Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:45

1. General Information

Building	Control Building
Default Level-to-Level Height	5000 mm
Default Ceiling Space	Yes
Default Floor-to-Ceiling Height	3100 mm
Default Raised Floor	No
Default Window Opening Elevation	1000 mm
Validation Errors	None
Notes	None

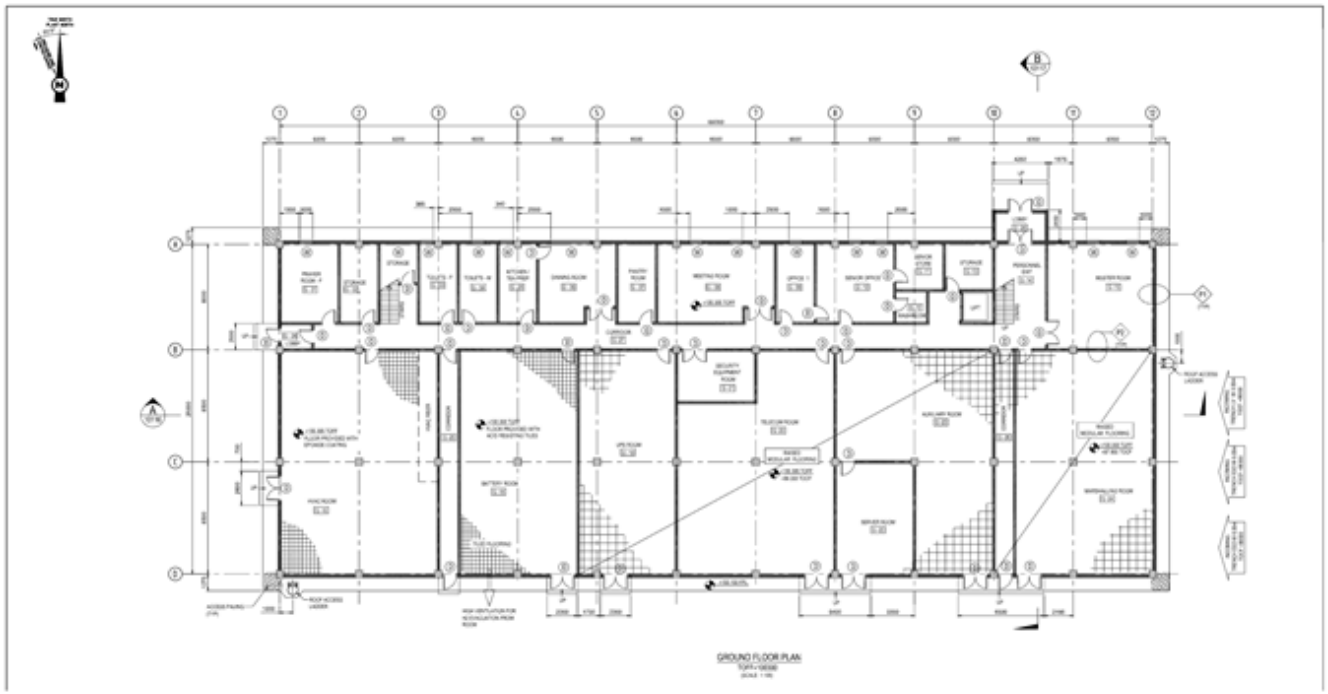
2. Floor Plan Images

2.1. Summary of Floor Plan Images

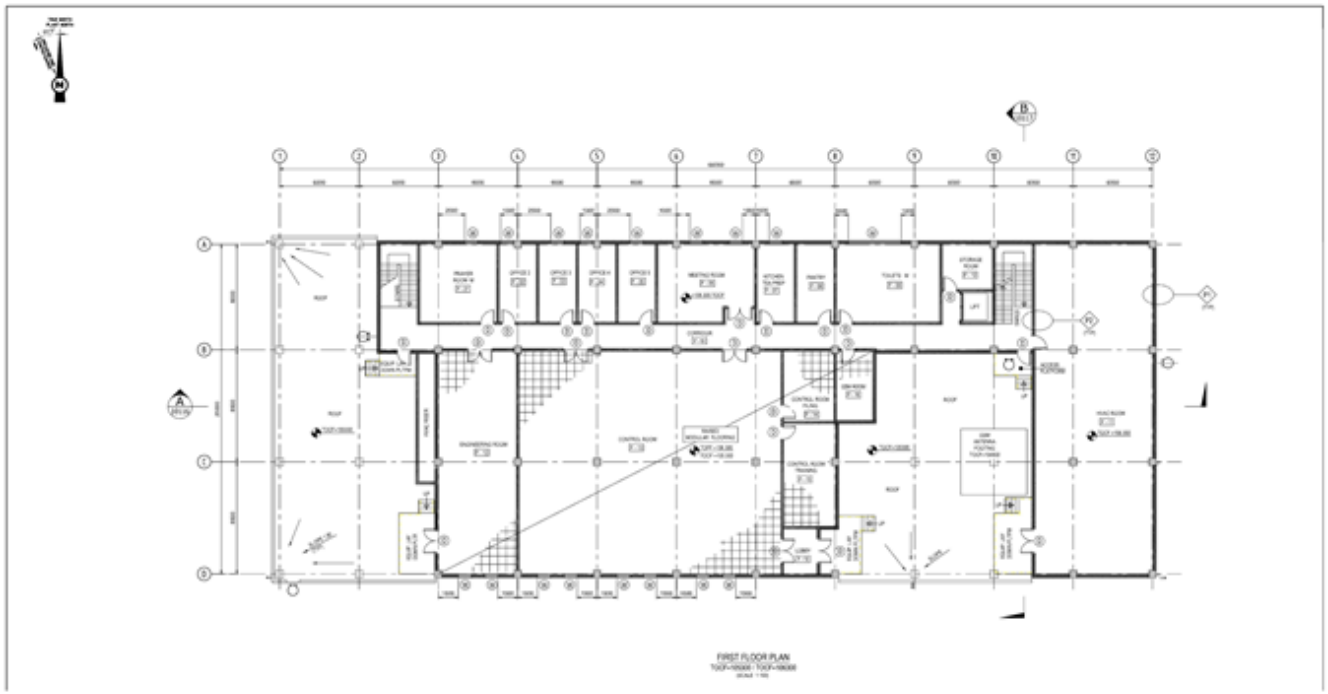
Floor Plan Image	North Orientation (deg)	Scale	Used in Level(s)
01 Ground Floor.pdf	0,0	1:100	Level 0 - Office, Level 0 - Office Low, Level 0 - Tech, Level 0 - Tech FF
02 First Floor.pdf	0,0	1:100	Level 1 - Office, Level 1 - Tech FF, Roof Level 0 - Office, Roof Level 0 - Office Low, Roof Level 0 - Tech, Roof Level 0 - Tech FF, Roof Level 1, Roof Level 1 - Tech FF
03 Second Floor.pdf	0,0	1:100	Level 2 - Office, Roof Level 2

2.2. Floor Plan Images

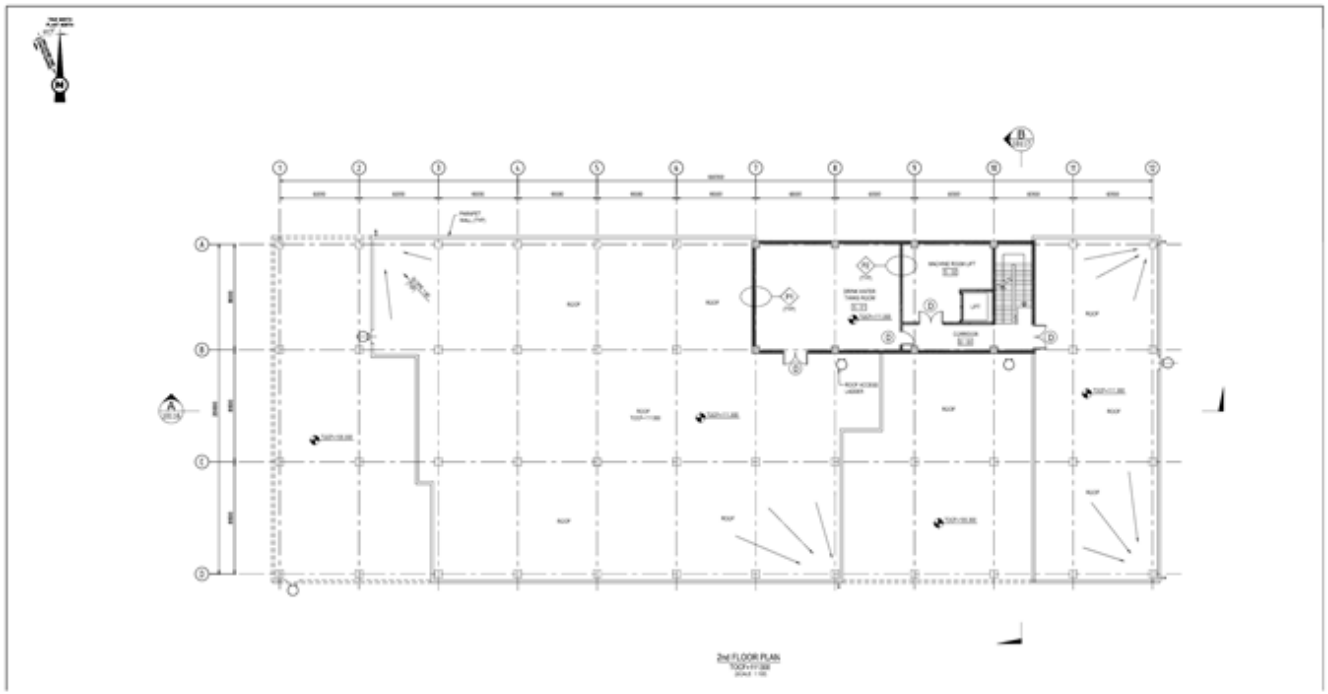
01 Ground Floor.pdf:



02 First Floor.pdf:



03 Second Floor.pdf:



3. Levels

Level	Vertical Position	Override General Defaults	Level-to-Level Height	Floor-to-Ceiling Height	Default Opening Elevation	Raised Floor Height	Associated Floor Plan Image
Roof Level 2	Above Level 2 - Office	-	-	-	-	-	03 Second Floor.pdf
Level 2 - Office	Above Level 1 - Office	No	5000 mm	3100 mm	1000 mm	-	03 Second Floor.pdf
Roof Level 1	Above Level 1 - Office	-	-	-	-	-	02 First Floor.pdf
Roof Level 1 - Tech FF	Above Level 1 - Tech FF	-	-	-	-	-	02 First Floor.pdf
Level 1 - Office	Above Level 0 - Office	No	5000 mm	3100 mm	1000 mm	-	02 First Floor.pdf
Roof Level 0 - Office	Above Level 0 - Office	-	-	-	-	-	02 First Floor.pdf
Level 1 - Tech FF	Above Level 0 - Tech FF	Yes	6000 mm	3100 mm	1000 mm	1000 mm	02 First Floor.pdf
Roof Level 0 - Office Low	Above Level 0 - Office Low	-	-	-	-	-	02 First Floor.pdf
Roof Level 0 - Tech	Above Level 0 - Tech	-	-	-	-	-	02 First Floor.pdf
Roof Level 0 - Tech FF	Above Level 0 - Tech FF	-	-	-	-	-	02 First Floor.pdf
Level 0 - Office	At-grade	Yes	6000 mm	3100 mm	1000 mm	-	01 Ground Floor.pdf
Level 0 - Office Low	At-grade	Yes	5000 mm	3100 mm	1000 mm	-	01 Ground Floor.pdf
Level 0 - Tech	At-grade	Yes	5000 mm	-	1000 mm	-	01 Ground Floor.pdf
Level 0 - Tech FF	-1000 mm (below grade)	Yes	6000 mm	3100 mm	1000 mm	1000 mm	01 Ground Floor.pdf

4. Walls & Spaces, Roofs

4.1. Building Summary (Occupiable Levels)

Level	Space Count	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)
Level 2 - Office	3	168,0	840,1	130,4	290,0
Level 1 - Office	12	468,4	2341,9	852,2	454,9
Level 1 - Tech FF	7	677,3	4064,0	416,8	660,7
Level 0 - Office	15	478,1	2868,6	995,2	453,1
Level 0 - Office Low	4	60,0	300,0	144,2	77,5
Level 0 - Tech	3	384,6	1923,1	538,4	198,1
Level 0 - Tech FF	7	739,0	4433,7	761,3	423,1
Total	51	2975,4	16771,3	3838,5	2557,4

4.2. Building Summary (Roof Levels)

Level	Section Count	Total Roof Area (sqm)	Heat Transfer Area (sqm)	Exterior Wall Gross Area (sqm)
Roof Level 2	1	168,0	168,0	0,0
Roof Level 1	2	300,4	300,4	0,0
Roof Level 1 - Tech FF	2	677,3	677,3	0,0
Roof Level 0 - Office	1	9,7	9,7	0,0
Roof Level 0 - Office Low	1	60,0	60,0	0,0
Roof Level 0 - Tech	1	204,8	204,8	0,0
Roof Level 0 - Tech FF	1	241,4	241,4	0,0
Implied Roofs	30	1661,6	1661,6	0,0
Total	39	3323,2	3323,2	0,0

4.3. Space Details

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
Level 2 - Office								
1.1.18 Corridor (2)	43,9	136,1	46,6	64,9	No	3100 mm	-	

Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:45

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
1.2.07 Machine Room	35,9	111,4	59,0	21,8	No	3100 mm	-	
1.2.08 Water Tanks	88,2	273,3	24,8	93,1	No	3100 mm	-	
Ceiling/Floor Spaces	-	319,2	-	110,2	-	-	-	
Level 1 - Office								
1.1.01 Corridor (1)	147,3	456,8	307,7	94,3	No	3100 mm	-	
1.1.03 Toilets M	49,4	153,2	62,7	25,5	No	3100 mm	-	
1.1.04 Prayer Room M	36,1	111,9	55,9	18,6	No	3100 mm	-	
1.1.05 Meeting Room (1)	41,9	129,8	60,5	23,2	No	3100 mm	-	
1.1.06 Office 2	18,1	56,1	46,6	9,3	No	3100 mm	-	
1.1.07 Office 3	18,1	56,2	46,6	9,3	No	3100 mm	-	
1.1.08 Office 4	17,9	55,5	46,5	9,2	No	3100 mm	-	
1.1.09 Office 5	18,0	55,9	46,5	9,3	No	3100 mm	-	
1.1.10 Kitchen / Tea Prep. (1)	18,2	56,4	46,6	9,4	No	3100 mm	-	
1.1.11 Pantry (1)	17,9	55,5	46,5	9,2	No	3100 mm	-	
1.1.12 Storage Room (1)	13,2	40,8	33,4	11,7	No	3100 mm	-	
1.1.17 HVAC Room (1)	72,3	224,0	52,8	52,8	No	3100 mm	-	
Ceiling/Floor Spaces	-	889,9	-	172,9	-	-	-	
Level 1 - Tech FF								
0.2.02 GSM Room	16,2	50,2	26,1	26,1	No	3100 mm	1000 mm	
1.1.02 Lobby (Control Room)	9,3	29,0	19,1	19,1	No	3100 mm	1000 mm	
1.1.13 Control Room Filing	22,1	68,4	58,9	0,0	No	3100 mm	1000 mm	
1.1.14 Control Room Training	32,1	99,6	45,6	29,0	No	3100 mm	1000 mm	
1.1.15 Control Room	341,7	1059,4	167,8	62,3	No	3100 mm	1000 mm	
1.1.16 Engineering Room	102,2	316,8	71,4	71,4	No	3100 mm	1000 mm	
1.1.17 HVAC Room (1)	153,6	476,3	28,0	133,5	No	3100 mm	-	
Ceiling/Floor Spaces	-	1964,3	-	319,4	-	-	-	
Level 0 - Office								

Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:45

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
0.1.01 Corridor (0)	152,3	472,2	397,5	0,0	No	3100 mm	-	
0.1.02 Lobby (North)	9,7	30,1	12,3	27,5	No	3100 mm	-	
0.1.06 Washroom (Senior Office)	6,4	19,9	31,4	0,0	No	3100 mm	-	
0.1.07 Toilets M	18,0	55,9	46,5	9,3	No	3100 mm	-	
0.1.08 Toilets F	18,1	56,0	46,6	9,3	No	3100 mm	-	
0.1.09 Dinning Room	32,9	101,9	55,8	18,6	No	3100 mm	-	
0.1.10 Kitchen / Tea Prep (0)	18,1	56,1	46,6	9,3	No	3100 mm	-	
0.1.11 Pantry (0)	18,0	55,9	46,5	9,3	No	3100 mm	-	
0.1.13 Muster Room	64,2	199,0	49,7	49,7	No	3100 mm	-	
0.1.14 Senior Office	36,1	112,0	55,9	18,7	No	3100 mm	-	
0.1.15 Office 1	18,1	56,1	46,6	9,3	No	3100 mm	-	
0.1.16 Meeting Room (0)	50,9	157,9	65,2	27,9	No	3100 mm	-	
0.1.17 Storage (East)	13,2	40,8	33,4	11,7	No	3100 mm	-	
0.1.19 Storage (Stairs)	9,1	28,3	28,1	9,4	No	3100 mm	-	
0.1.20 Senior Store	12,9	40,1	33,1	11,4	No	3100 mm	-	
Ceiling/Floor Spaces	-	1386,5	-	231,6	-	-	-	
Level 0 - Office Low								
0.1.01 Corridor (0)	10,0	30,9	43,4	0,0	No	3100 mm	-	
0.1.03 Lobby (West)	5,0	15,5	21,7	6,2	No	3100 mm	-	
0.1.12 Prayer Room F	27,2	84,4	32,7	32,7	No	3100 mm	-	
0.1.18 Storage (West)	17,8	55,1	46,4	9,2	No	3100 mm	-	
Ceiling/Floor Spaces	-	114,0	-	29,5	-	-	-	
Level 0 - Tech								
0.1.04 Corridor (SW)	27,2	135,8	178,1	8,0	No	-	-	
0.1.21 HVAC Room (0)	204,8	1023,9	145,3	145,3	No	-	-	
0.3 Battery Room	152,7	763,4	215,0	44,9	No	-	-	
Ceiling/Floor Spaces	-	0,0	-	0,0	-	-	-	

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
Level 0 - Tech FF								
0.1.05 Corridor (SE)	27,4	84,9	110,5	5,0	No	3100 mm	1000 mm	
0.2.01 Telecom Room	179,7	557,0	142,6	37,1	No	3100 mm	1000 mm	
1.2.01 Marshaling Room	177,2	549,2	85,0	85,0	No	3100 mm	1000 mm	
1.2.02 Auxiliary Room	151,8	470,7	161,0	18,4	No	3100 mm	1000 mm	
1.2.03 Server Room	51,0	158,0	71,4	18,5	No	3100 mm	1000 mm	
1.2.04 UPS Room	127,9	396,4	128,8	23,3	No	3100 mm	1000 mm	
1.2.05 Security Equipment Room	24,1	74,6	62,0	0,0	No	3100 mm	1000 mm	
Ceiling/Floor Spaces	-	2142,9	-	235,7	-	-	-	

4.4. Unmodeled Space Details

None

4.5. Roof Details

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 2						
Roof Level 2	Flat	168,0	168,0	-	-	
Level 2 - Office						
Ceiling Space for 1.1.18 Corridor (2)	Flat	43,9	43,9	-	-	
Ceiling Space for 1.2.07 Machine Room	Flat	35,9	35,9	-	-	
Ceiling Space for 1.2.08 Water Tanks	Flat	88,2	88,2	-	-	
Roof Level 1						
Roof Level 1 NE	Flat	71,9	71,9	-	-	
Roof Level 1 NW	Flat	228,5	228,5	-	-	
Roof Level 1 - Tech FF						
Roof Level 1 SE	Flat	153,6	153,6	-	-	

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 1 SW	Flat	523,7	523,7	-	-	
Level 1 - Office						
Ceiling Space for 1.1.01 Corridor (1)	Flat	78,3	78,3	-	-	
Ceiling Space for 1.1.04 Prayer Room M	Flat	36,1	36,1	-	-	
Ceiling Space for 1.1.05 Meeting Room (1)	Flat	41,9	41,9	-	-	
Ceiling Space for 1.1.06 Office 2	Flat	18,1	18,1	-	-	
Ceiling Space for 1.1.07 Office 3	Flat	18,1	18,1	-	-	
Ceiling Space for 1.1.08 Office 4	Flat	17,9	17,9	-	-	
Ceiling Space for 1.1.09 Office 5	Flat	18,0	18,0	-	-	
Ceiling Space for 1.1.10 Kitchen / Tea Prep. (1)	Flat	0,1	0,1	-	-	
Ceiling Space for 1.1.17 HVAC Room (1)	Flat	71,9	71,9	-	-	
Roof Level 0 - Office						
Roof Level 0 N	Flat	9,7	9,7	-	-	
Level 1 - Tech FF						
Ceiling Space for 0.2.02 GSM Room	Flat	16,2	16,2	-	-	
Ceiling Space for 1.1.02 Lobby (Control Room)	Flat	9,3	9,3	-	-	
Ceiling Space for 1.1.13 Control Room Filing	Flat	22,1	22,1	-	-	
Ceiling Space for 1.1.14 Control Room Training	Flat	32,1	32,1	-	-	
Ceiling Space for 1.1.15 Control Room	Flat	341,7	341,7	-	-	
Ceiling Space for 1.1.16 Engineering Room	Flat	102,2	102,2	-	-	
Ceiling Space for 1.1.17 HVAC Room (1)	Flat	153,6	153,6	-	-	
Roof Level 0 - Office Low						
Roof Level 0 - SW	Flat	60,0	60,0	-	-	
Roof Level 0 - Tech						
Roof Level 0 SE	Flat	204,8	204,8	-	-	

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 0 - Tech FF						
Roof Level 0 SE	Flat	241,4	241,4	-	-	
Level 0 - Office						
Ceiling Space for 0.1.02 Lobby (North)	Flat	9,7	9,7	-	-	
Level 0 - Office Low						
Ceiling Space for 0.1.01 Corridor (0)	Flat	10,0	10,0	-	-	
Ceiling Space for 0.1.03 Lobby (West)	Flat	5,0	5,0	-	-	
Ceiling Space for 0.1.12 Prayer Room F	Flat	27,2	27,2	-	-	
Ceiling Space for 0.1.18 Storage (West)	Flat	17,8	17,8	-	-	
Level 0 - Tech						
0.1.21 HVAC Room (0)	Flat	204,8	204,8	-	-	
Level 0 - Tech FF						
Ceiling Space for 0.1.05 Corridor (SE)	Flat	27,4	27,4	-	-	
Ceiling Space for 0.2.01 Telecom Room	Flat	4,5	4,5	-	-	
Ceiling Space for 1.2.01 Marshaling Room	Flat	23,5	23,5	-	-	
Ceiling Space for 1.2.02 Auxiliary Room	Flat	135,2	135,2	-	-	
Ceiling Space for 1.2.03 Server Room	Flat	50,7	50,7	-	-	

4.6. Summary of Wall Groups

Wall Group	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Notes
Default	0.0	0.0	
Air Walls	0.0	0.0	
Wall External	21,7	2390,3	
Wall Internal	3816,8	167,1	

5. Openings

5.1. Schedule of Window Openings

Tag	Count	Total Area (sqm)	Width	Height	Elevation	Exterior Shade	Notes
Door FF	5	20,0	2000 mm	2000 mm	1000 mm	None	
Door FF Single	1	2,0	1000 mm	2000 mm	1000 mm	None	
Window 1x1	28	33,6	1000 mm	1200 mm	1000 mm	None	
Window Toilet 4x0,7	1	2,8	4000 mm	700 mm	1500 mm	None	
Window Toilet 1x0,7	2	1,4	1000 mm	700 mm	1500 mm	None	

5.2. Schedule of Door Openings

Tag	Count	Total Area (sqm)	Width	Height	Shade	Notes
Door Double	8	32,0	2000 mm	2000 mm	None	
Door Single	4	8,0	1000 mm	2000 mm	None	

5.3. Schedule of Skylight Openings

None

IPS - Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:48

1. General Information

Building	IPS - Control Building
Default Level-to-Level Height	5000 mm
Default Ceiling Space	Yes
Default Floor-to-Ceiling Height	3100 mm
Default Raised Floor	No
Default Window Opening Elevation	1000 mm
Validation Errors	None
Notes	None

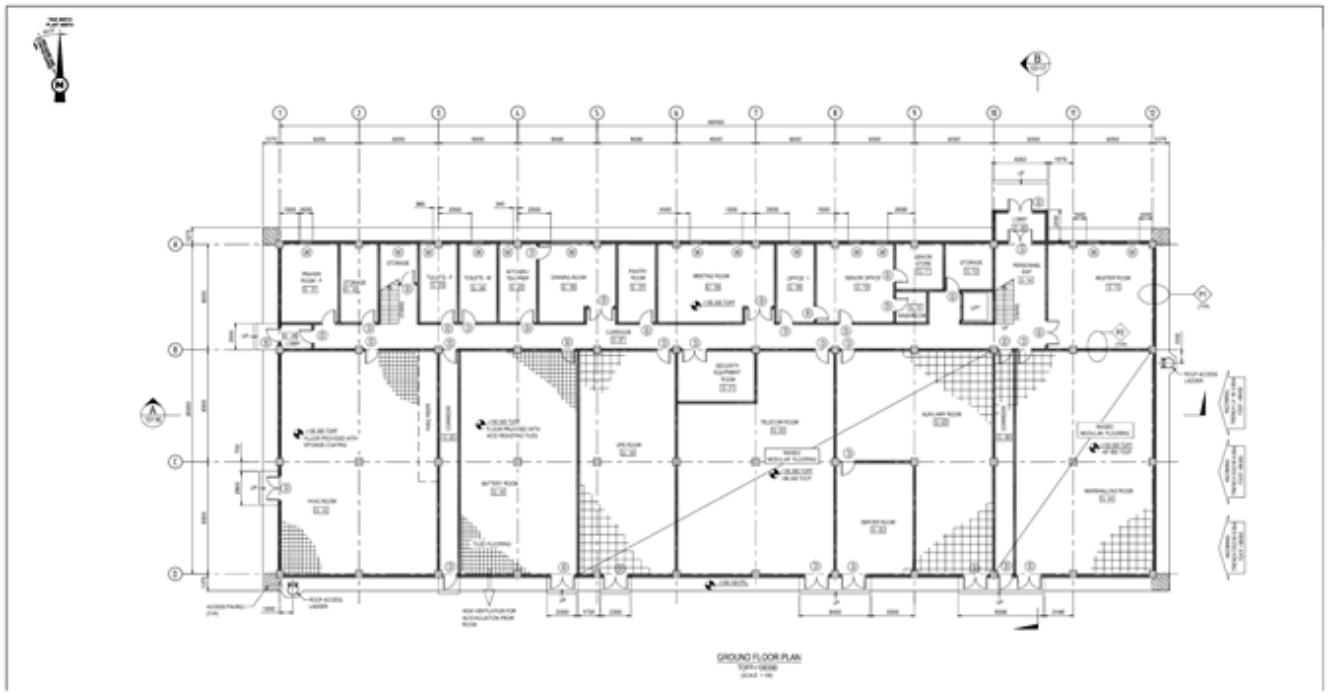
2. Floor Plan Images

2.1. Summary of Floor Plan Images

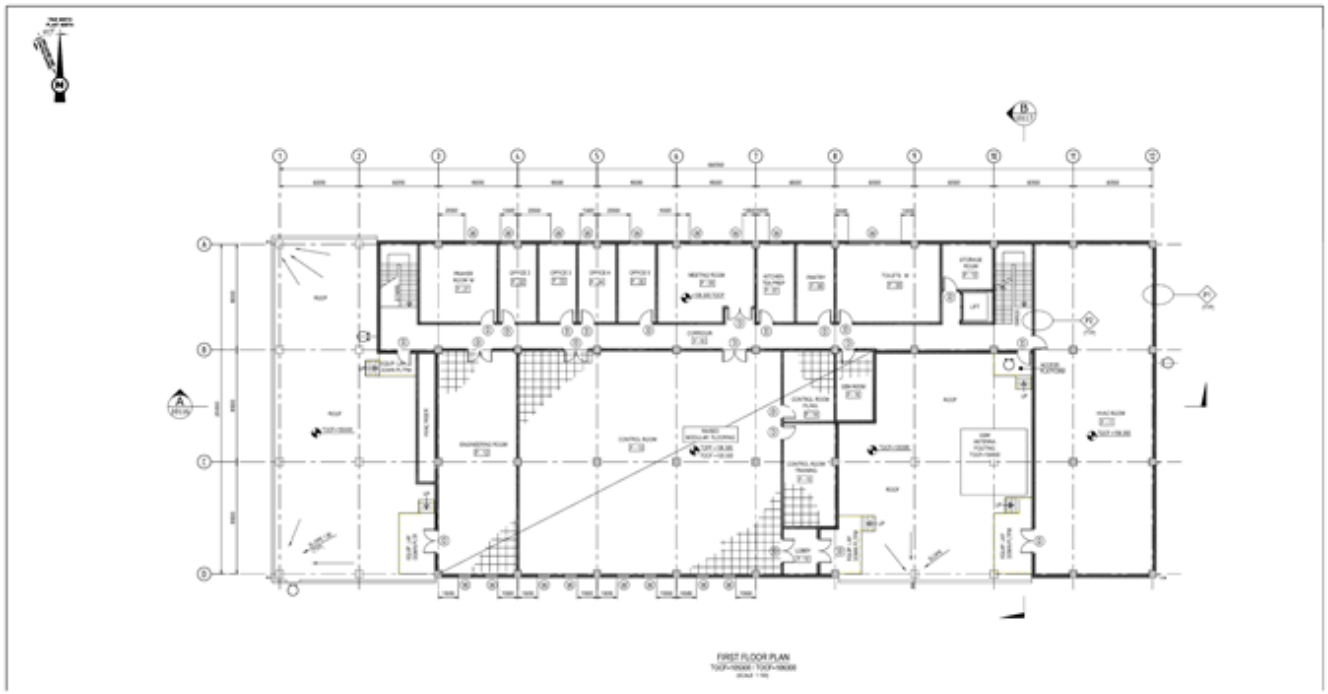
Floor Plan Image	North Orientation (deg)	Scale	Used in Level(s)
01 Ground Floor.pdf	0,0	1:100	Level 0 - Office, Level 0 - Office Low, Level 0 - Tech, Level 0 - Tech FF
02 First Floor.pdf	0,0	1:100	Level 1 - Office, Level 1 - Tech FF, Roof Level 0 - Office, Roof Level 0 - Office Low, Roof Level 0 - Tech, Roof Level 0 - Tech FF, Roof Level 1, Roof Level 1 - Tech FF
03 Second Floor.pdf	0,0	1:100	Level 2 - Office, Roof Level 2

2.2. Floor Plan Images

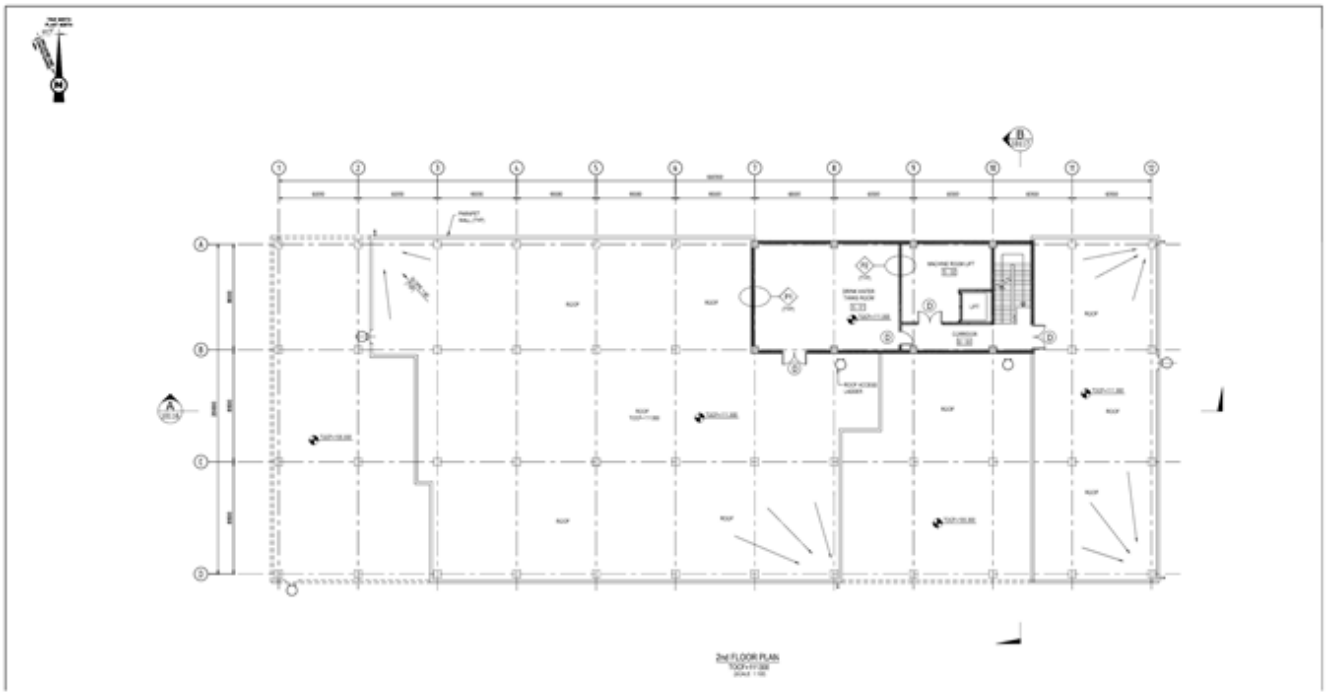
01 Ground Floor.pdf:



02 First Floor.pdf:



03 Second Floor.pdf:



3. Levels

Level	Vertical Position	Override General Defaults	Level-to-Level Height	Floor-to-Ceiling Height	Default Opening Elevation	Raised Floor Height	Associated Floor Plan Image
Roof Level 2	Above Level 2 - Office	-	-	-	-	-	03 Second Floor.pdf
Level 2 - Office	Above Level 1 - Office	No	5000 mm	3100 mm	1000 mm	-	03 Second Floor.pdf
Roof Level 1	Above Level 1 - Office	-	-	-	-	-	02 First Floor.pdf
Roof Level 1 - Tech FF	Above Level 1 - Tech FF	-	-	-	-	-	02 First Floor.pdf
Level 1 - Office	Above Level 0 - Office	No	5000 mm	3100 mm	1000 mm	-	02 First Floor.pdf
Roof Level 0 - Office	Above Level 0 - Office	-	-	-	-	-	02 First Floor.pdf
Level 1 - Tech FF	Above Level 0 - Tech FF	Yes	6000 mm	3100 mm	1000 mm	1000 mm	02 First Floor.pdf
Roof Level 0 - Office Low	Above Level 0 - Office Low	-	-	-	-	-	02 First Floor.pdf
Roof Level 0 - Tech	Above Level 0 - Tech	-	-	-	-	-	02 First Floor.pdf
Roof Level 0 - Tech FF	Above Level 0 - Tech FF	-	-	-	-	-	02 First Floor.pdf
Level 0 - Office	At-grade	Yes	6000 mm	3100 mm	1000 mm	-	01 Ground Floor.pdf
Level 0 - Office Low	At-grade	Yes	5000 mm	3100 mm	1000 mm	-	01 Ground Floor.pdf
Level 0 - Tech	At-grade	Yes	5000 mm	-	1000 mm	-	01 Ground Floor.pdf
Level 0 - Tech FF	-1000 mm (below grade)	Yes	6000 mm	3100 mm	1000 mm	1000 mm	01 Ground Floor.pdf

4. Walls & Spaces, Roofs

4.1. Building Summary (Occupiable Levels)

Level	Space Count	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)
Level 2 - Office	3	168,0	840,1	130,4	290,0
Level 1 - Office	12	468,4	2341,9	852,2	454,9
Level 1 - Tech FF	7	677,3	4064,0	416,8	660,7
Level 0 - Office	15	478,1	2868,6	995,2	453,1
Level 0 - Office Low	4	60,0	300,0	144,2	77,5
Level 0 - Tech	3	384,6	1923,1	538,4	198,1
Level 0 - Tech FF	7	739,0	4433,7	761,3	423,1
Total	51	2975,4	16771,3	3838,5	2557,4

4.2. Building Summary (Roof Levels)

Level	Section Count	Total Roof Area (sqm)	Heat Transfer Area (sqm)	Exterior Wall Gross Area (sqm)
Roof Level 2	1	168,0	168,0	0,0
Roof Level 1	2	300,4	300,4	0,0
Roof Level 1 - Tech FF	2	677,3	677,3	0,0
Roof Level 0 - Office	1	9,7	9,7	0,0
Roof Level 0 - Office Low	1	60,0	60,0	0,0
Roof Level 0 - Tech	1	204,8	204,8	0,0
Roof Level 0 - Tech FF	1	241,4	241,4	0,0
Implied Roofs	30	1661,6	1661,6	0,0
Total	39	3323,2	3323,2	0,0

4.3. Space Details

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
Level 2 - Office								
1.1.18 Corridor (2)	43,9	136,1	46,6	64,9	No	3100 mm	-	

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
1.2.07 Machine Room	35,9	111,4	59,0	21,8	No	3100 mm	-	
1.2.08 Water Tanks	88,2	273,3	24,8	93,1	No	3100 mm	-	
Ceiling/Floor Spaces	-	319,2	-	110,2	-	-	-	
Level 1 - Office								
1.1.01 Corridor (1)	147,3	456,8	307,7	94,3	No	3100 mm	-	
1.1.03 Toilets M	49,4	153,2	62,7	25,5	No	3100 mm	-	
1.1.04 Prayer Room M	36,1	111,9	55,9	18,6	No	3100 mm	-	
1.1.05 Meeting Room (1)	41,9	129,8	60,5	23,2	No	3100 mm	-	
1.1.06 Office 2	18,1	56,1	46,6	9,3	No	3100 mm	-	
1.1.07 Office 3	18,1	56,2	46,6	9,3	No	3100 mm	-	
1.1.08 Office 4	17,9	55,5	46,5	9,2	No	3100 mm	-	
1.1.09 Office 5	18,0	55,9	46,5	9,3	No	3100 mm	-	
1.1.10 Kitchen / Tea Prep. (1)	18,2	56,4	46,6	9,4	No	3100 mm	-	
1.1.11 Pantry (1)	17,9	55,5	46,5	9,2	No	3100 mm	-	
1.1.12 Storage Room (1)	13,2	40,8	33,4	11,7	No	3100 mm	-	
1.1.17 HVAC Room (1)	72,3	224,0	52,8	52,8	No	3100 mm	-	
Ceiling/Floor Spaces	-	889,9	-	172,9	-	-	-	
Level 1 - Tech FF								
0.1.23 GSM Room	16,2	50,2	26,1	26,1	No	3100 mm	1000 mm	
1.1.02 Lobby (Control Room)	9,3	29,0	19,1	19,1	No	3100 mm	1000 mm	
1.1.13 Control Room Filing	22,1	68,4	58,9	0,0	No	3100 mm	1000 mm	
1.1.14 Control Room Training	32,1	99,6	45,6	29,0	No	3100 mm	1000 mm	
1.1.15 Control Room	341,7	1059,4	167,8	62,3	No	3100 mm	1000 mm	
1.1.16 Engineering Room	102,2	316,8	71,4	71,4	No	3100 mm	1000 mm	
1.1.17 HVAC Room (1)	153,6	476,3	28,0	133,5	No	3100 mm	-	
Ceiling/Floor Spaces	-	1964,3	-	319,4	-	-	-	
Level 0 - Office								

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
0.1.01 Corridor (0)	152,3	472,2	397,5	0,0	No	3100 mm	-	
0.1.02 Lobby (North)	9,7	30,1	12,3	27,5	No	3100 mm	-	
0.1.06 Washroom (Senior Office)	6,4	19,9	31,4	0,0	No	3100 mm	-	
0.1.07 Toilets M	18,0	55,9	46,5	9,3	No	3100 mm	-	
0.1.08 Toilets F	18,1	56,0	46,6	9,3	No	3100 mm	-	
0.1.09 Dinning Room	32,9	101,9	55,8	18,6	No	3100 mm	-	
0.1.10 Kitchen / Tea Prep (0)	18,1	56,1	46,6	9,3	No	3100 mm	-	
0.1.11 Pantry (0)	18,0	55,9	46,5	9,3	No	3100 mm	-	
0.1.13 Muster Room	64,2	199,0	49,7	49,7	No	3100 mm	-	
0.1.14 Senior Office	36,1	112,0	55,9	18,7	No	3100 mm	-	
0.1.15 Office 1	18,1	56,1	46,6	9,3	No	3100 mm	-	
0.1.16 Meeting Room (0)	50,9	157,9	65,2	27,9	No	3100 mm	-	
0.1.17 Storage (East)	13,2	40,8	33,4	11,7	No	3100 mm	-	
0.1.19 Storage (Stairs)	9,1	28,3	28,1	9,4	No	3100 mm	-	
0.1.20 Senior Store	12,9	40,1	33,1	11,4	No	3100 mm	-	
Ceiling/Floor Spaces	-	1386,5	-	231,6	-	-	-	
Level 0 - Office Low								
0.1.01 Corridor (0)	10,0	30,9	43,4	0,0	No	3100 mm	-	
0.1.03 Lobby (West)	5,0	15,5	21,7	6,2	No	3100 mm	-	
0.1.12 Prayer Room F	27,2	84,4	32,7	32,7	No	3100 mm	-	
0.1.18 Storage (West)	17,8	55,1	46,4	9,2	No	3100 mm	-	
Ceiling/Floor Spaces	-	114,0	-	29,5	-	-	-	
Level 0 - Tech								
0.1.04 Corridor (SW)	27,2	135,8	178,1	8,0	No	-	-	
0.1.22 HVAC Room (0)	204,8	1023,9	145,3	145,3	No	-	-	
1.2.06 Battery Room	152,7	763,4	215,0	44,9	No	-	-	
Ceiling/Floor Spaces	-	0,0	-	0,0	-	-	-	

Space	Floor Area (sqm)	Volume (m3)	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Multi-Level	Floor-to-Ceiling Height	Raised Floor Height	Notes
Level 0 - Tech FF								
0.1.05 Corridor (SE)	27,4	84,9	110,5	5,0	No	3100 mm	1000 mm	
0.1.21 Telecom Room	179,7	557,0	142,6	37,1	No	3100 mm	1000 mm	
1.2.01 Marshaling Room	177,2	549,2	85,0	85,0	No	3100 mm	1000 mm	
1.2.02 Auxiliary Room	151,8	470,7	161,0	18,4	No	3100 mm	1000 mm	
1.2.03 Server Room	51,0	158,0	71,4	18,5	No	3100 mm	1000 mm	
1.2.04 UPS Room	127,9	396,4	128,8	23,3	No	3100 mm	1000 mm	
1.2.05 Security Equipment Room	24,1	74,6	62,0	0,0	No	3100 mm	1000 mm	
Ceiling/Floor Spaces	-	2142,9	-	235,7	-	-	-	

4.4. Unmodeled Space Details

None

4.5. Roof Details

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 2						
Roof Level 2	Flat	168,0	168,0	-	-	
Level 2 - Office						
Ceiling Space for 1.1.18 Corridor (2)	Flat	43,9	43,9	-	-	
Ceiling Space for 1.2.07 Machine Room	Flat	35,9	35,9	-	-	
Ceiling Space for 1.2.08 Water Tanks	Flat	88,2	88,2	-	-	
Roof Level 1						
Roof Level 1 NE	Flat	71,9	71,9	-	-	
Roof Level 1 NW	Flat	228,5	228,5	-	-	
Roof Level 1 - Tech FF						
Roof Level 1 SE	Flat	153,6	153,6	-	-	

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 1 SW	Flat	523,7	523,7	-	-	
Level 1 - Office						
Ceiling Space for 1.1.01 Corridor (1)	Flat	78,3	78,3	-	-	
Ceiling Space for 1.1.04 Prayer Room M	Flat	36,1	36,1	-	-	
Ceiling Space for 1.1.05 Meeting Room (1)	Flat	41,9	41,9	-	-	
Ceiling Space for 1.1.06 Office 2	Flat	18,1	18,1	-	-	
Ceiling Space for 1.1.07 Office 3	Flat	18,1	18,1	-	-	
Ceiling Space for 1.1.08 Office 4	Flat	17,9	17,9	-	-	
Ceiling Space for 1.1.09 Office 5	Flat	18,0	18,0	-	-	
Ceiling Space for 1.1.10 Kitchen / Tea Prep. (1)	Flat	0,1	0,1	-	-	
Ceiling Space for 1.1.17 HVAC Room (1)	Flat	71,9	71,9	-	-	
Roof Level 0 - Office						
Roof Level 0 N	Flat	9,7	9,7	-	-	
Level 1 - Tech FF						
Ceiling Space for 0.1.23 GSM Room	Flat	16,2	16,2	-	-	
Ceiling Space for 1.1.02 Lobby (Control Room)	Flat	9,3	9,3	-	-	
Ceiling Space for 1.1.13 Control Room Filing	Flat	22,1	22,1	-	-	
Ceiling Space for 1.1.14 Control Room Training	Flat	32,1	32,1	-	-	
Ceiling Space for 1.1.15 Control Room	Flat	341,7	341,7	-	-	
Ceiling Space for 1.1.16 Engineering Room	Flat	102,2	102,2	-	-	
Ceiling Space for 1.1.17 HVAC Room (1)	Flat	153,6	153,6	-	-	
Roof Level 0 - Office Low						
Roof Level 0 - SW	Flat	60,0	60,0	-	-	
Roof Level 0 - Tech						
Roof Level 0 SE	Flat	204,8	204,8	-	-	

Name	Shape	Total Area (sqm)	Heat Transfer Area (sqm)	Pitch		Notes
				Pitch A	Pitch B	
Roof Level 0 - Tech FF						
Roof Level 0 SE	Flat	241,4	241,4	-	-	
Level 0 - Office						
Ceiling Space for 0.1.02 Lobby (North)	Flat	9,7	9,7	-	-	
Level 0 - Office Low						
Ceiling Space for 0.1.01 Corridor (0)	Flat	10,0	10,0	-	-	
Ceiling Space for 0.1.03 Lobby (West)	Flat	5,0	5,0	-	-	
Ceiling Space for 0.1.12 Prayer Room F	Flat	27,2	27,2	-	-	
Ceiling Space for 0.1.18 Storage (West)	Flat	17,8	17,8	-	-	
Level 0 - Tech						
0.1.22 HVAC Room (0)	Flat	204,8	204,8	-	-	
Level 0 - Tech FF						
Ceiling Space for 0.1.05 Corridor (SE)	Flat	27,4	27,4	-	-	
Ceiling Space for 0.1.21 Telecom Room	Flat	4,5	4,5	-	-	
Ceiling Space for 1.2.01 Marshaling Room	Flat	23,5	23,5	-	-	
Ceiling Space for 1.2.02 Auxiliary Room	Flat	135,2	135,2	-	-	
Ceiling Space for 1.2.03 Server Room	Flat	50,7	50,7	-	-	

4.6. Summary of Wall Groups

Wall Group	Interior Wall Gross Area (sqm)	Exterior Wall Gross Area (sqm)	Notes
Default	0.0	0.0	
Air Walls	0.0	0.0	
Wall External	21,7	2390,3	
Wall Internal	3816,8	167,1	

5. Openings

5.1. Schedule of Window Openings

Tag	Count	Total Area (sqm)	Width	Height	Elevation	Exterior Shade	Notes
Door FF	5	20,0	2000 mm	2000 mm	1000 mm	None	
Door FF Single	1	2,0	1000 mm	2000 mm	1000 mm	None	
Window 1x1	28	33,6	1000 mm	1200 mm	1000 mm	None	
Window Toilet 4x0,7	1	2,8	4000 mm	700 mm	1500 mm	None	
Window Toilet 1x0,7	2	1,4	1000 mm	700 mm	1500 mm	None	

5.2. Schedule of Door Openings

Tag	Count	Total Area (sqm)	Width	Height	Shade	Notes
Door Double	8	32,0	2000 mm	2000 mm	None	
Door Single	4	8,0	1000 mm	2000 mm	None	

5.3. Schedule of Skylight Openings

None

1. General Information

Space Model ..... Civil - Control Building
Building ..... Control Building
Notes:

2. Spaces

The space model contains 51 spaces with total floor area of 32 027 sqm.

2.1. Ventilation

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
1	0.1.01 Corridor (0)	Level 0 - Office Low	10,0	Space	User Defined	10,0	L/s	0,0	L/s	10,0	L/s
2	0.1.01 Corridor (0)	Level 0 - Office	152,3	Space	User Defined	73,0	L/s	0,0	L/s	73,0	L/s
3	0.1.02 Lobby (North)	Level 0 - Office	9,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
4	0.1.03 Lobby (West)	Level 0 - Office Low	5,0	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
5	0.1.04 Corridor (SW)	Level 0 - Tech	27,2	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
6	0.1.05 Corridor (SE)	Level 0 - Tech FF	27,4	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
7	0.1.06 Washroom (Senior Office)	Level 0 - Office	6,4	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s
8	0.1.07 Toilets M	Level 0 - Office	18,0	Space	User Defined	181,0	L/s	0,0	L/s	181,0	L/s
9	0.1.08 Toilets F	Level 0 - Office	18,1	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
10	0.1.09 Dinning Room	Level 0 - Office	32,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
11	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office	18,1	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
12	0.1.11 Pantry (0)	Level 0 - Office	18,0	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
13	0.1.12 Prayer Room F	Level 0 - Office Low	27,2	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
14	0.1.13 Muster Room	Level 0 - Office	64,2	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
15	0.1.14 Senior Office	Level 0 - Office	36,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
16	0.1.15 Office 1	Level 0 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
17	0.1.16 Meeting Room (0)	Level 0 - Office	50,9	Space	User Defined	208,0	L/s	0,0	L/s	208,0	L/s
18	0.1.17 Storage (East)	Level 0 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s
19	0.1.18 Storage (West)	Level 0 - Office Low	17,8	Space	User Defined	69,0	L/s	0,0	L/s	69,0	L/s
20	0.1.19 Storage (Stairs)	Level 0 - Office	9,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
21	0.1.20 Senior Store	Level 0 - Office	12,9	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
22	0.1.21 HVAC Room (0)	Level 0 - Tech	204,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
23	0.2.01 Telecom Room	Level 0 - Tech FF	179,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
24	0.2.02 GSM Room	Level 1 - Tech FF	16,2	Space	User Defined	14,0	L/s	0,0	L/s	14,0	L/s
25	0.3 Battery Room	Level 0 - Tech	152,7	Space	User Defined	2 486,0	L/s	0,0	L/s	2 486,0	L/s
26	1.1.01 Corridor (1)	Level 1 - Office	147,3	Space	User Defined	361,0	L/s	0,0	L/s	361,0	L/s
27	1.1.02 Lobby (Control Room)	Level 1 - Tech FF	9,3	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
28	1.1.03 Toilets M	Level 1 - Office	49,4	Space	User Defined	486,0	L/s	0,0	L/s	486,0	L/s
29	1.1.04 Prayer Room M	Level 1 - Office	36,1	Space	User Defined	139,0	L/s	0,0	L/s	139,0	L/s
30	1.1.05 Meeting Room (1)	Level 1 - Office	41,9	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
31	1.1.06 Office 2	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
32	1.1.07 Office 3	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
33	1.1.08 Office 4	Level 1 - Office	17,9	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
34	1.1.09 Office 5	Level 1 - Office	18,0	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
35	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office	18,2	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
36	1.1.11 Pantry (1)	Level 1 - Office	17,9	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
37	1.1.12 Storage Room (1)	Level 1 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
38	1.1.13 Control Room Filing	Level 1 - Tech FF	22,1	Space	User Defined	97,0	L/s	0,0	L/s	97,0	L/s
39	1.1.14 Control Room Training	Level 1 - Tech FF	32,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
40	1.1.15 Control Room	Level 1 - Tech FF	341,7	Space	User Defined	194,0	L/s	0,0	L/s	194,0	L/s
41	1.1.16 Engineering Room	Level 1 - Tech FF	102,2	Space	User Defined	167,0	L/s	0,0	L/s	208,0	L/s
42	1.1.17 HVAC Room (1)	Level 1 - Office	72,3	Space	User Defined	67,0	L/s	0,0	L/s	67,0	L/s
43	1.1.17 HVAC Room (1)	Level 1 - Tech FF	153,6	Space	User Defined	100,0	L/s	0,0	L/s	100,0	L/s
44	1.1.18 Corridor (2)	Level 2 - Office	43,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
45	1.2.01 Marshaling Room	Level 0 - Tech FF	177,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
46	1.2.02 Auxiliary Room	Level 0 - Tech FF	151,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
47	1.2.03 Server Room	Level 0 - Tech FF	51,0	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
48	1.2.04 UPS Room	Level 0 - Tech FF	127,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
49	1.2.05 Security Equipment Room	Level 0 - Tech FF	24,1	Space	User Defined	14,0	L/s	0,0	L/s	14,0	L/s
50	1.2.07 Machine Room	Level 2 - Office	35,9	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
51	1.2.08 Water Tanks	Level 2 - Office	88,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s

2.2. Overhead Lighting and Daylighting Control

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
1	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
2	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
3	0.1.02 Lobby (North)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
4	0.1.03 Lobby (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
5	0.1.04 Corridor (SW)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
6	0.1.05 Corridor (SE)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
7	0.1.06 Washroom (Senior Office)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
8	0.1.07 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
9	0.1.08 Toilets F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
10	0.1.09 Dinning Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
11	0.1.10 Kitchen / Tea Prep (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
12	0.1.11 Pantry (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
13	0.1.12 Prayer Room F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
14	0.1.13 Muster Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
15	0.1.14 Senior Office	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
16	0.1.15 Office 1	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
17	0.1.16 Meeting Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
18	0.1.17 Storage (East)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
19	0.1.18 Storage (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
20	0.1.19 Storage (Stairs)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
21	0.1.20 Senior Store	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
22	0.1.21 HVAC Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
23	0.2.01 Telecom Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
24	0.2.02 GSM Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
25	0.3 Battery Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
26	1.1.01 Corridor (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
27	1.1.02 Lobby (Control Room)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
28	1.1.03 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
29	1.1.04 Prayer Room M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
30	1.1.05 Meeting Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
31	1.1.06 Office 2	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
32	1.1.07 Office 3	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
33	1.1.08 Office 4	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
34	1.1.09 Office 5	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
35	1.1.10 Kitchen / Tea Prep. (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
36	1.1.11 Pantry (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
37	1.1.12 Storage Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
38	1.1.13 Control Room Filing	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
39	1.1.14 Control Room Training	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
40	1.1.15 Control Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - CR Light	1,00	Not Used	---	---
41	1.1.16 Engineering Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
42	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
43	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
44	1.1.18 Corridor (2)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
45	1.2.01 Marshaling Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
46	1.2.02 Auxiliary Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
47	1.2.03 Server Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
48	1.2.04 UPS Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
49	1.2.05 Security Equipment Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
50	1.2.07 Machine Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
51	1.2.08 Water Tanks	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---

2.3. Task Lighting, Electric Equipment and Miscellaneous Heat Gain

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
1	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
2	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
3	0.1.02 Lobby (North)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
4	0.1.03 Lobby (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
5	0.1.04 Corridor (SW)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
6	0.1.05 Corridor (SE)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
7	0.1.06 Washroom (Senior Office)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
8	0.1.07 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
9	0.1.08 Toilets F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
10	0.1.09 Dinning Room	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
11	0.1.10 Kitchen / Tea Prep (0)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
12	0.1.11 Pantry (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
13	0.1.12 Prayer Room F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
14	0.1.13 Muster Room	0,00	W/sqm	(None)	195,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
15	0.1.14 Senior Office	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
16	0.1.15 Office 1	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
17	0.1.16 Meeting Room (0)	0,00	W/sqm	(None)	700,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
18	0.1.17 Storage (East)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
19	0.1.18 Storage (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
20	0.1.19 Storage (Stairs)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
21	0.1.20 Senior Store	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
22	0.1.21 HVAC Room (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
23	0.2.01 Telecom Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
24	0.2.02 GSM Room	0,00	W/sqm	(None)	2 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
25	0.3 Battery Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
26	1.1.01 Corridor (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
27	1.1.02 Lobby (Control Room)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
28	1.1.03 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
29	1.1.04 Prayer Room M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
30	1.1.05 Meeting Room (1)	0,00	W/sqm	(None)	500,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
31	1.1.06 Office 2	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
32	1.1.07 Office 3	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
33	1.1.08 Office 4	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
34	1.1.09 Office 5	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
35	1.1.10 Kitchen / Tea Prep. (1)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
36	1.1.11 Pantry (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
37	1.1.12 Storage Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
38	1.1.13 Control Room Filing	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
39	1.1.14 Control Room Training	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
40	1.1.15 Control Room	0,00	W/sqm	(None)	775,0	Watts	Schedule - CR Equipment	0	(None)	0	(None)
41	1.1.16 Engineering Room	0,00	W/sqm	(None)	475,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
42	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
43	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
44	1.1.18 Corridor (2)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
45	1.2.01 Marshaling Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
46	1.2.02 Auxiliary Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
47	1.2.03 Server Room	0,00	W/sqm	(None)	9 740,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
48	1.2.04 UPS Room	0,00	W/sqm	(None)	24 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
49	1.2.05 Security Equipment Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
50	1.2.07 Machine Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
51	1.2.08 Water Tanks	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

2.4. Occupancy and Infiltration

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
1	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
2	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
3	0.1.02 Lobby (North)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
4	0.1.03 Lobby (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
5	0.1.04 Corridor (SW)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
6	0.1.05 Corridor (SE)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
7	0.1.06 Washroom (Senior Office)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
8	0.1.07 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
9	0.1.08 Toilets F	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
10	0.1.09 Dinning Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
11	0.1.10 Kitchen / Tea Prep (0)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
12	0.1.11 Pantry (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
13	0.1.12 Prayer Room F	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
14	0.1.13 Muster Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
15	0.1.14 Senior Office	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
16	0.1.15 Office 1	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
17	0.1.16 Meeting Room (0)	15	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
18	0.1.17 Storage (East)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
19	0.1.18 Storage (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
20	0.1.19 Storage (Stairs)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
21	0.1.20 Senior Store	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
22	0.1.21 HVAC Room (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
23	0.2.01 Telecom Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
24	0.2.02 GSM Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
25	0.3 Battery Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
26	1.1.01 Corridor (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
27	1.1.02 Lobby (Control Room)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
28	1.1.03 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
29	1.1.04 Prayer Room M	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
30	1.1.05 Meeting Room (1)	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
31	1.1.06 Office 2	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
32	1.1.07 Office 3	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
33	1.1.08 Office 4	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
34	1.1.09 Office 5	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
35	1.1.10 Kitchen / Tea Prep. (1)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
36	1.1.11 Pantry (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
37	1.1.12 Storage Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
38	1.1.13 Control Room Filing	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
39	1.1.14 Control Room Training	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
40	1.1.15 Control Room	5	People	Schedule - CR People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
41	1.1.16 Engineering Room	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
42	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
43	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
44	1.1.18 Corridor (2)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
45	1.2.01 Marshaling Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
46	1.2.02 Auxiliary Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
47	1.2.03 Server Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
48	1.2.04 UPS Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
49	1.2.05 Security Equipment Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
50	1.2.07 Machine Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
51	1.2.08 Water Tanks	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

3. Zoning

Zone	Space	Level
0.1.01 Corridor (0)		
	0.1.01 Corridor (0)	Level 0 - Office
	0.1.01 Corridor (0)	Level 0 - Office Low
0.1.02 Lobby (North)		
	0.1.02 Lobby (North)	Level 0 - Office
0.1.03 Lobby (West)		
	0.1.03 Lobby (West)	Level 0 - Office Low
0.1.04 Corridor (SW)		
	0.1.04 Corridor (SW)	Level 0 - Tech
0.1.05 Corridor (SE)		
	0.1.05 Corridor (SE)	Level 0 - Tech FF
0.1.06 Washroom (Senior Office)		
	0.1.06 Washroom (Senior Office)	Level 0 - Office
0.1.07 Toilets M		
	0.1.07 Toilets M	Level 0 - Office
0.1.08 Toilets F		
	0.1.08 Toilets F	Level 0 - Office
0.1.09 Dinning Room		
	0.1.09 Dinning Room	Level 0 - Office
0.1.10 Kitchen / Tea Prep (0)		
	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office
0.1.11 Pantry (0)		
	0.1.11 Pantry (0)	Level 0 - Office
0.1.12 Prayer Room F		
	0.1.12 Prayer Room F	Level 0 - Office Low
0.1.13 Muster Room		

Zone	Space	Level
	0.1.13 Muster Room	Level 0 - Office
0.1.14 Senior Office		
	0.1.14 Senior Office	Level 0 - Office
0.1.15 Office 1		
	0.1.15 Office 1	Level 0 - Office
0.1.16 Meeting Room (0)		
	0.1.16 Meeting Room (0)	Level 0 - Office
0.1.17 Storage (East)		
	0.1.17 Storage (East)	Level 0 - Office
0.1.18 Storage (West)		
	0.1.18 Storage (West)	Level 0 - Office Low
0.1.19 Storage (Stairs)		
	0.1.19 Storage (Stairs)	Level 0 - Office
0.1.20 Senior Store		
	0.1.20 Senior Store	Level 0 - Office
0.1.21 HVAC Room (0)		
	0.1.21 HVAC Room (0)	Level 0 - Tech
0.2.01 Telecom Room		
	0.2.01 Telecom Room	Level 0 - Tech FF
0.2.02 GSM Room		
	0.2.02 GSM Room	Level 1 - Tech FF
0.3 Battery Room		
	0.3 Battery Room	Level 0 - Tech
1.1.01 Corridor (1)		
	1.1.01 Corridor (1)	Level 1 - Office
1.1.02 Lobby (Control Room)		
	1.1.02 Lobby (Control Room)	Level 1 - Tech FF
1.1.03 Toilets M		

Zone	Space	Level
	1.1.03 Toilets M	Level 1 - Office
1.1.04 Prayer Room M		
	1.1.04 Prayer Room M	Level 1 - Office
1.1.05 Meeting Room (1)		
	1.1.05 Meeting Room (1)	Level 1 - Office
1.1.06 Office 2		
	1.1.06 Office 2	Level 1 - Office
1.1.07 Office 3		
	1.1.07 Office 3	Level 1 - Office
1.1.08 Office 4		
	1.1.08 Office 4	Level 1 - Office
1.1.09 Office 5		
	1.1.09 Office 5	Level 1 - Office
1.1.10 Kitchen / Tea Prep. (1)		
	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office
1.1.11 Pantry (1)		
	1.1.11 Pantry (1)	Level 1 - Office
1.1.12 Storage Room (1)		
	1.1.12 Storage Room (1)	Level 1 - Office
1.1.13 Control Room Filing		
	1.1.13 Control Room Filing	Level 1 - Tech FF
1.1.14 Control Room Training		
	1.1.14 Control Room Training	Level 1 - Tech FF
1.1.15 Control Room		
	1.1.15 Control Room	Level 1 - Tech FF
1.1.16 Engineering Room		
	1.1.16 Engineering Room	Level 1 - Tech FF
1.1.17 HVAC Room (1)		

Zone	Space	Level
	1.1.17 HVAC Room (1)	Level 1 - Office
	1.1.17 HVAC Room (1)	Level 1 - Tech FF
1.1.18 Corridor (2)		
	1.1.18 Corridor (2)	Level 2 - Office
1.2.01 Marshaling Room		
	1.2.01 Marshaling Room	Level 0 - Tech FF
1.2.02 Auxiliary Room		
	1.2.02 Auxiliary Room	Level 0 - Tech FF
1.2.03 Server Room		
	1.2.03 Server Room	Level 0 - Tech FF
1.2.04 UPS Room		
	1.2.04 UPS Room	Level 0 - Tech FF
1.2.05 Security Equipment Room		
	1.2.05 Security Equipment Room	Level 0 - Tech FF
1.2.07 Machine Room		
	1.2.07 Machine Room	Level 2 - Office
1.2.08 Water Tanks		
	1.2.08 Water Tanks	Level 2 - Office
Unconditioned (no spaces)		
Unassigned (no spaces)		

4. Assemblies

Category	Surface Group	Selected Assembly
Exterior Above Grade Wall		
	Wall External	Civil - Wall Exterior - Above grade (average)
	Wall Internal	Civil - Wall Exterior - Above grade (average)
Exterior Below Grade Wall		
	Wall External	Civil - Wall Exterior - Below grade
	Wall Internal	Civil - Wall Exterior - Below grade
Interior Wall		
	Wall External	Wall Interior
	Wall Internal	Wall Interior
Roof		
	Default	Civil - Roof
Ceiling		
	Interior Ceilings	Acoustic Tile Ceiling
Floor Above Space		
	Interior Floors Above Space	Floor interior
	Raised Floors	False Floor
Slab Floor On Grade		
	At-Grade Floors	Civil - Floor exterior - On grade
Slab Floor Below Grade		
	Below Grade Floors	Civil - Floor exterior - Below grade

5. Windows & Doors

Category	Tag	Width x Height, Elevation	Selected Assembly
Window			
	Door FF	2000 mm x 2000 mm, 1000 mm	Door FF
	Door FF Single	1000 mm x 2000 mm, 1000 mm	Door FF
	Window 1x1	1000 mm x 1200 mm, 1000 mm	Window
	Window Toilet 4x0,7	4000 mm x 700 mm, 1500 mm	Window
	Window Toilet 1x0,7	1000 mm x 700 mm, 1500 mm	Window
Door			
	Door Double	2000 mm x 2000 mm	Door
	Door Single	1000 mm x 2000 mm	Door

ASHRAE 90.1 Vertical Glazing Summary:

Total Window Opening Glazing Area	59,8	sqm
Total Door Opening Glazing Area	0,0	sqm
Total Gross Above Grade Wall Area	2436,5	sqm
Window-to-wall Ratio (WWR)	2,3	%

HVAC - Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:50

1. General Information

Space Model ..... HVAC - Control Building
Building ..... Control Building
Notes:

2. Spaces

The space model contains 51 spaces with total floor area of 32 027 sqm.

2.1. Ventilation

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
1	0.1.01 Corridor (0)	Level 0 - Office Low	10,0	Space	User Defined	10,0	L/s	0,0	L/s	10,0	L/s
2	0.1.01 Corridor (0)	Level 0 - Office	152,3	Space	User Defined	73,0	L/s	0,0	L/s	73,0	L/s
3	0.1.02 Lobby (North)	Level 0 - Office	9,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
4	0.1.03 Lobby (West)	Level 0 - Office Low	5,0	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
5	0.1.04 Corridor (SW)	Level 0 - Tech	27,2	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
6	0.1.05 Corridor (SE)	Level 0 - Tech FF	27,4	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
7	0.1.06 Washroom (Senior Office)	Level 0 - Office	6,4	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s
8	0.1.07 Toilets M	Level 0 - Office	18,0	Space	User Defined	181,0	L/s	0,0	L/s	181,0	L/s
9	0.1.08 Toilets F	Level 0 - Office	18,1	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
10	0.1.09 Dinning Room	Level 0 - Office	32,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
11	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office	18,1	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
12	0.1.11 Pantry (0)	Level 0 - Office	18,0	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
13	0.1.12 Prayer Room F	Level 0 - Office Low	27,2	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
14	0.1.13 Muster Room	Level 0 - Office	64,2	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
15	0.1.14 Senior Office	Level 0 - Office	36,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
16	0.1.15 Office 1	Level 0 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
17	0.1.16 Meeting Room (0)	Level 0 - Office	50,9	Space	User Defined	208,0	L/s	0,0	L/s	208,0	L/s
18	0.1.17 Storage (East)	Level 0 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s
19	0.1.18 Storage (West)	Level 0 - Office Low	17,8	Space	User Defined	69,0	L/s	0,0	L/s	69,0	L/s
20	0.1.19 Storage (Stairs)	Level 0 - Office	9,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
21	0.1.20 Senior Store	Level 0 - Office	12,9	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
22	0.1.21 HVAC Room (0)	Level 0 - Tech	204,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
23	0.2.01 Telecom Room	Level 0 - Tech FF	179,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
24	0.2.02 GSM Room	Level 1 - Tech FF	16,2	Space	User Defined	14,0	L/s	0,0	L/s	14,0	L/s
25	0.3 Battery Room	Level 0 - Tech	152,7	Space	User Defined	2 486,0	L/s	0,0	L/s	2 486,0	L/s
26	1.1.01 Corridor (1)	Level 1 - Office	147,3	Space	User Defined	361,0	L/s	0,0	L/s	361,0	L/s
27	1.1.02 Lobby (Control Room)	Level 1 - Tech FF	9,3	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
28	1.1.03 Toilets M	Level 1 - Office	49,4	Space	User Defined	486,0	L/s	0,0	L/s	486,0	L/s
29	1.1.04 Prayer Room M	Level 1 - Office	36,1	Space	User Defined	139,0	L/s	0,0	L/s	139,0	L/s
30	1.1.05 Meeting Room (1)	Level 1 - Office	41,9	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
31	1.1.06 Office 2	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
32	1.1.07 Office 3	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
33	1.1.08 Office 4	Level 1 - Office	17,9	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
34	1.1.09 Office 5	Level 1 - Office	18,0	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
35	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office	18,2	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
36	1.1.11 Pantry (1)	Level 1 - Office	17,9	Space	User Defined	153,0	L/s	0,0	L/s	153,0	L/s
37	1.1.12 Storage Room (1)	Level 1 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s

HVAC - Control Building

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Prepared by: IPS 11:50

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
38	1.1.13 Control Room Filing	Level 1 - Tech FF	22,1	Space	User Defined	97,0	L/s	0,0	L/s	97,0	L/s
39	1.1.14 Control Room Training	Level 1 - Tech FF	32,1	Space	User Defined	42,0	L/s	0,0	L/s	42,0	L/s
40	1.1.15 Control Room	Level 1 - Tech FF	341,7	Space	User Defined	194,0	L/s	0,0	L/s	194,0	L/s
41	1.1.16 Engineering Room	Level 1 - Tech FF	102,2	Space	User Defined	167,0	L/s	0,0	L/s	208,0	L/s
42	1.1.17 HVAC Room (1)	Level 1 - Office	72,3	Space	User Defined	67,0	L/s	0,0	L/s	67,0	L/s
43	1.1.17 HVAC Room (1)	Level 1 - Tech FF	153,6	Space	User Defined	100,0	L/s	0,0	L/s	100,0	L/s
44	1.1.18 Corridor (2)	Level 2 - Office	43,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
45	1.2.01 Marshaling Room	Level 0 - Tech FF	177,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
46	1.2.02 Auxiliary Room	Level 0 - Tech FF	151,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
47	1.2.03 Server Room	Level 0 - Tech FF	51,0	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
48	1.2.04 UPS Room	Level 0 - Tech FF	127,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
49	1.2.05 Security Equipment Room	Level 0 - Tech FF	24,1	Space	User Defined	14,0	L/s	0,0	L/s	14,0	L/s
50	1.2.07 Machine Room	Level 2 - Office	35,9	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
51	1.2.08 Water Tanks	Level 2 - Office	88,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s

2.2. Overhead Lighting and Daylighting Control

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
1	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
2	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
3	0.1.02 Lobby (North)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
4	0.1.03 Lobby (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
5	0.1.04 Corridor (SW)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
6	0.1.05 Corridor (SE)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
7	0.1.06 Washroom (Senior Office)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
8	0.1.07 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
9	0.1.08 Toilets F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
10	0.1.09 Dinning Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
11	0.1.10 Kitchen / Tea Prep (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
12	0.1.11 Pantry (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
13	0.1.12 Prayer Room F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
14	0.1.13 Muster Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
15	0.1.14 Senior Office	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
16	0.1.15 Office 1	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
17	0.1.16 Meeting Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
18	0.1.17 Storage (East)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
19	0.1.18 Storage (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
20	0.1.19 Storage (Stairs)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
21	0.1.20 Senior Store	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
22	0.1.21 HVAC Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
23	0.2.01 Telecom Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
24	0.2.02 GSM Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
25	0.3 Battery Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
26	1.1.01 Corridor (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
27	1.1.02 Lobby (Control Room)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
28	1.1.03 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
29	1.1.04 Prayer Room M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
30	1.1.05 Meeting Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
31	1.1.06 Office 2	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
32	1.1.07 Office 3	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
33	1.1.08 Office 4	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
34	1.1.09 Office 5	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
35	1.1.10 Kitchen / Tea Prep. (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
36	1.1.11 Pantry (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
37	1.1.12 Storage Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
38	1.1.13 Control Room Filing	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
39	1.1.14 Control Room Training	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
40	1.1.15 Control Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - CR Light	1,00	Not Used	---	---
41	1.1.16 Engineering Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
42	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

HVAC - Control Building

Project: Calculations 10-05-2025
Prepared by: IPS 11:50

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
43	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
44	1.1.18 Corridor (2)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
45	1.2.01 Marshaling Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
46	1.2.02 Auxiliary Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
47	1.2.03 Server Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
48	1.2.04 UPS Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
49	1.2.05 Security Equipment Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
50	1.2.07 Machine Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
51	1.2.08 Water Tanks	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---

2.3. Task Lighting, Electric Equipment and Miscellaneous Heat Gain

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
1	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
2	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
3	0.1.02 Lobby (North)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
4	0.1.03 Lobby (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
5	0.1.04 Corridor (SW)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
6	0.1.05 Corridor (SE)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
7	0.1.06 Washroom (Senior Office)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
8	0.1.07 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
9	0.1.08 Toilets F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
10	0.1.09 Dinning Room	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
11	0.1.10 Kitchen / Tea Prep (0)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
12	0.1.11 Pantry (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
13	0.1.12 Prayer Room F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
14	0.1.13 Muster Room	0,00	W/sqm	(None)	195,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
15	0.1.14 Senior Office	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
16	0.1.15 Office 1	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
17	0.1.16 Meeting Room (0)	0,00	W/sqm	(None)	700,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
18	0.1.17 Storage (East)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
19	0.1.18 Storage (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
20	0.1.19 Storage (Stairs)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
21	0.1.20 Senior Store	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
22	0.1.21 HVAC Room (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
23	0.2.01 Telecom Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
24	0.2.02 GSM Room	0,00	W/sqm	(None)	2 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
25	0.3 Battery Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
26	1.1.01 Corridor (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
27	1.1.02 Lobby (Control Room)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
28	1.1.03 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
29	1.1.04 Prayer Room M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
30	1.1.05 Meeting Room (1)	0,00	W/sqm	(None)	500,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
31	1.1.06 Office 2	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
32	1.1.07 Office 3	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
33	1.1.08 Office 4	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
34	1.1.09 Office 5	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
35	1.1.10 Kitchen / Tea Prep. (1)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
36	1.1.11 Pantry (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
37	1.1.12 Storage Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
38	1.1.13 Control Room Filing	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
39	1.1.14 Control Room Training	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
40	1.1.15 Control Room	0,00	W/sqm	(None)	775,0	Watts	Schedule - CR Equipment	0	(None)	0	(None)
41	1.1.16 Engineering Room	0,00	W/sqm	(None)	475,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
42	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
43	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
44	1.1.18 Corridor (2)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
45	1.2.01 Marshaling Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
46	1.2.02 Auxiliary Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
47	1.2.03 Server Room	0,00	W/sqm	(None)	9 740,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
48	1.2.04 UPS Room	0,00	W/sqm	(None)	24 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
49	1.2.05 Security Equipment Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
50	1.2.07 Machine Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
51	1.2.08 Water Tanks	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

2.4. Occupancy and Infiltration

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
1	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
2	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
3	0.1.02 Lobby (North)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
4	0.1.03 Lobby (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
5	0.1.04 Corridor (SW)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
6	0.1.05 Corridor (SE)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
7	0.1.06 Washroom (Senior Office)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
8	0.1.07 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
9	0.1.08 Toilets F	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
10	0.1.09 Dinning Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
11	0.1.10 Kitchen / Tea Prep (0)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
12	0.1.11 Pantry (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
13	0.1.12 Prayer Room F	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
14	0.1.13 Muster Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
15	0.1.14 Senior Office	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
16	0.1.15 Office 1	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
17	0.1.16 Meeting Room (0)	15	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
18	0.1.17 Storage (East)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
19	0.1.18 Storage (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
20	0.1.19 Storage (Stairs)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
21	0.1.20 Senior Store	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
22	0.1.21 HVAC Room (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
23	0.2.01 Telecom Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
24	0.2.02 GSM Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
25	0.3 Battery Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
26	1.1.01 Corridor (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
27	1.1.02 Lobby (Control Room)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
28	1.1.03 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
29	1.1.04 Prayer Room M	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
30	1.1.05 Meeting Room (1)	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
31	1.1.06 Office 2	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
32	1.1.07 Office 3	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
33	1.1.08 Office 4	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
34	1.1.09 Office 5	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
35	1.1.10 Kitchen / Tea Prep. (1)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
36	1.1.11 Pantry (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
37	1.1.12 Storage Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
38	1.1.13 Control Room Filing	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
39	1.1.14 Control Room Training	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
40	1.1.15 Control Room	5	People	Schedule - CR People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
41	1.1.16 Engineering Room	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
42	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
43	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
44	1.1.18 Corridor (2)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
45	1.2.01 Marshaling Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
46	1.2.02 Auxiliary Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
47	1.2.03 Server Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
48	1.2.04 UPS Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
49	1.2.05 Security Equipment Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
50	1.2.07 Machine Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
51	1.2.08 Water Tanks	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

3. Zoning

Zone	Space	Level
0.1.01 Corridor (0)		
	0.1.01 Corridor (0)	Level 0 - Office
	0.1.01 Corridor (0)	Level 0 - Office Low
0.1.02 Lobby (North)		
	0.1.02 Lobby (North)	Level 0 - Office
0.1.03 Lobby (West)		
	0.1.03 Lobby (West)	Level 0 - Office Low
0.1.04 Corridor (SW)		
	0.1.04 Corridor (SW)	Level 0 - Tech
0.1.05 Corridor (SE)		
	0.1.05 Corridor (SE)	Level 0 - Tech FF
0.1.06 Washroom (Senior Office)		
	0.1.06 Washroom (Senior Office)	Level 0 - Office
0.1.07 Toilets M		
	0.1.07 Toilets M	Level 0 - Office
0.1.08 Toilets F		
	0.1.08 Toilets F	Level 0 - Office
0.1.09 Dinning Room		
	0.1.09 Dinning Room	Level 0 - Office
0.1.10 Kitchen / Tea Prep (0)		
	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office
0.1.11 Pantry (0)		
	0.1.11 Pantry (0)	Level 0 - Office
0.1.12 Prayer Room F		
	0.1.12 Prayer Room F	Level 0 - Office Low
0.1.13 Muster Room		

Zone	Space	Level
	0.1.13 Muster Room	Level 0 - Office
0.1.14 Senior Office		
	0.1.14 Senior Office	Level 0 - Office
0.1.15 Office 1		
	0.1.15 Office 1	Level 0 - Office
0.1.16 Meeting Room (0)		
	0.1.16 Meeting Room (0)	Level 0 - Office
0.1.17 Storage (East)		
	0.1.17 Storage (East)	Level 0 - Office
0.1.18 Storage (West)		
	0.1.18 Storage (West)	Level 0 - Office Low
0.1.19 Storage (Stairs)		
	0.1.19 Storage (Stairs)	Level 0 - Office
0.1.20 Senior Store		
	0.1.20 Senior Store	Level 0 - Office
0.1.21 HVAC Room (0)		
	0.1.21 HVAC Room (0)	Level 0 - Tech
0.2.01 Telecom Room		
	0.2.01 Telecom Room	Level 0 - Tech FF
0.2.02 GSM Room		
	0.2.02 GSM Room	Level 1 - Tech FF
0.3 Battery Room		
	0.3 Battery Room	Level 0 - Tech
1.1.01 Corridor (1)		
	1.1.01 Corridor (1)	Level 1 - Office
1.1.02 Lobby (Control Room)		
	1.1.02 Lobby (Control Room)	Level 1 - Tech FF
1.1.03 Toilets M		

Zone	Space	Level
	1.1.03 Toilets M	Level 1 - Office
1.1.04 Prayer Room M		
	1.1.04 Prayer Room M	Level 1 - Office
1.1.05 Meeting Room (1)		
	1.1.05 Meeting Room (1)	Level 1 - Office
1.1.06 Office 2		
	1.1.06 Office 2	Level 1 - Office
1.1.07 Office 3		
	1.1.07 Office 3	Level 1 - Office
1.1.08 Office 4		
	1.1.08 Office 4	Level 1 - Office
1.1.09 Office 5		
	1.1.09 Office 5	Level 1 - Office
1.1.10 Kitchen / Tea Prep. (1)		
	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office
1.1.11 Pantry (1)		
	1.1.11 Pantry (1)	Level 1 - Office
1.1.12 Storage Room (1)		
	1.1.12 Storage Room (1)	Level 1 - Office
1.1.13 Control Room Filing		
	1.1.13 Control Room Filing	Level 1 - Tech FF
1.1.14 Control Room Training		
	1.1.14 Control Room Training	Level 1 - Tech FF
1.1.15 Control Room		
	1.1.15 Control Room	Level 1 - Tech FF
1.1.16 Engineering Room		
	1.1.16 Engineering Room	Level 1 - Tech FF
1.1.17 HVAC Room (1)		

Zone	Space	Level
	1.1.17 HVAC Room (1)	Level 1 - Office
	1.1.17 HVAC Room (1)	Level 1 - Tech FF
1.1.18 Corridor (2)		
	1.1.18 Corridor (2)	Level 2 - Office
1.2.01 Marshaling Room		
	1.2.01 Marshaling Room	Level 0 - Tech FF
1.2.02 Auxiliary Room		
	1.2.02 Auxiliary Room	Level 0 - Tech FF
1.2.03 Server Room		
	1.2.03 Server Room	Level 0 - Tech FF
1.2.04 UPS Room		
	1.2.04 UPS Room	Level 0 - Tech FF
1.2.05 Security Equipment Room		
	1.2.05 Security Equipment Room	Level 0 - Tech FF
1.2.07 Machine Room		
	1.2.07 Machine Room	Level 2 - Office
1.2.08 Water Tanks		
	1.2.08 Water Tanks	Level 2 - Office
Unconditioned (no spaces)		
Unassigned (no spaces)		

4. Assemblies

Category	Surface Group	Selected Assembly
Exterior Above Grade Wall		
	Wall External	HVAC - Wall Exterior - Above grade
	Wall Internal	HVAC - Wall Exterior - Above grade
Exterior Below Grade Wall		
	Wall External	HVAC - Wall Exterior - Below grade
	Wall Internal	HVAC - Wall Exterior - Below grade
Interior Wall		
	Wall External	Wall Interior
	Wall Internal	Wall Interior
Roof		
	Default	HVAC - Roof
Ceiling		
	Interior Ceilings	Acoustic Tile Ceiling
Floor Above Space		
	Interior Floors Above Space	Floor interior
	Raised Floors	False Floor
Slab Floor On Grade		
	At-Grade Floors	HVAC - Floor exterior - On grade
Slab Floor Below Grade		
	Below Grade Floors	HVAC - Floor exterior - Below grade

5. Windows & Doors

Category	Tag	Width x Height, Elevation	Selected Assembly
Window			
	Door FF	2000 mm x 2000 mm, 1000 mm	Door FF
	Door FF Single	1000 mm x 2000 mm, 1000 mm	Door FF
	Window 1x1	1000 mm x 1200 mm, 1000 mm	Window
	Window Toilet 4x0,7	4000 mm x 700 mm, 1500 mm	Window
	Window Toilet 1x0,7	1000 mm x 700 mm, 1500 mm	Window
Door			
	Door Double	2000 mm x 2000 mm	Door
	Door Single	1000 mm x 2000 mm	Door

ASHRAE 90.1 Vertical Glazing Summary:

Total Window Opening Glazing Area	59,8	sqm
Total Door Opening Glazing Area	0,0	sqm
Total Gross Above Grade Wall Area	2436,5	sqm
Window-to-wall Ratio (WWR)	2,3	%

1. General Information

Space Model ..... IPS - Control Building
Building ..... IPS - Control Building
Notes:

2. Spaces

The space model contains 51 spaces with total floor area of 32 027 sqm.

2.1. Ventilation

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
1	0.1.01 Corridor (0)	Level 0 - Office Low	10,0	Space	User Defined	10,0	L/s	0,0	L/s	0,0	L/s
2	0.1.01 Corridor (0)	Level 0 - Office	152,3	Space	User Defined	59,0	L/s	0,0	L/s	0,0	L/s
3	0.1.02 Lobby (North)	Level 0 - Office	9,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
4	0.1.03 Lobby (West)	Level 0 - Office Low	5,0	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
5	0.1.04 Corridor (SW)	Level 0 - Tech	27,2	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
6	0.1.05 Corridor (SE)	Level 0 - Tech FF	27,4	Space	User Defined	111,0	L/s	0,0	L/s	111,0	L/s
7	0.1.06 Washroom (Senior Office)	Level 0 - Office	6,4	Space	User Defined	56,0	L/s	0,0	L/s	56,0	L/s
8	0.1.07 Toilets M	Level 0 - Office	18,0	Space	User Defined	181,0	L/s	0,0	L/s	181,0	L/s
9	0.1.08 Toilets F	Level 0 - Office	18,1	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
10	0.1.09 Dinning Room	Level 0 - Office	32,9	Space	User Defined	167,0	L/s	0,0	L/s	0,0	L/s
11	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office	18,1	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
12	0.1.11 Pantry (0)	Level 0 - Office	18,0	Space	User Defined	153,0	L/s	0,0	L/s	0,0	L/s
13	0.1.12 Prayer Room F	Level 0 - Office Low	27,2	Space	User Defined	83,0	L/s	0,0	L/s	0,0	L/s
14	0.1.13 Muster Room	Level 0 - Office	64,2	Space	User Defined	153,0	L/s	0,0	L/s	0,0	L/s
15	0.1.14 Senior Office	Level 0 - Office	36,1	Space	User Defined	42,0	L/s	0,0	L/s	0,0	L/s

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
16	0.1.15 Office 1	Level 0 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	0,0	L/s
17	0.1.16 Meeting Room (0)	Level 0 - Office	50,9	Space	User Defined	208,0	L/s	0,0	L/s	0,0	L/s
18	0.1.17 Storage (East)	Level 0 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	0,0	L/s
19	0.1.18 Storage (West)	Level 0 - Office Low	17,8	Space	User Defined	69,0	L/s	0,0	L/s	0,0	L/s
20	0.1.19 Storage (Stairs)	Level 0 - Office	9,1	Space	User Defined	42,0	L/s	0,0	L/s	0,0	L/s
21	0.1.20 Senior Store	Level 0 - Office	12,9	Space	User Defined	42,0	L/s	0,0	L/s	0,0	L/s
22	0.1.21 Telecom Room	Level 0 - Tech FF	179,7	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
23	0.1.22 HVAC Room (0)	Level 0 - Tech	204,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
24	0.1.23 GSM Room	Level 1 - Tech FF	16,2	Space	User Defined	14,0	L/s	0,0	L/s	0,0	L/s
25	1.1.01 Corridor (1)	Level 1 - Office	147,3	Space	User Defined	361,0	L/s	0,0	L/s	361,0	L/s
26	1.1.02 Lobby (Control Room)	Level 1 - Tech FF	9,3	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
27	1.1.03 Toilets M	Level 1 - Office	49,4	Space	User Defined	486,0	L/s	0,0	L/s	486,0	L/s
28	1.1.04 Prayer Room M	Level 1 - Office	36,1	Space	User Defined	139,0	L/s	0,0	L/s	0,0	L/s
29	1.1.05 Meeting Room (1)	Level 1 - Office	41,9	Space	User Defined	153,0	L/s	0,0	L/s	0,0	L/s
30	1.1.06 Office 2	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	0,0	L/s
31	1.1.07 Office 3	Level 1 - Office	18,1	Space	User Defined	28,0	L/s	0,0	L/s	0,0	L/s
32	1.1.08 Office 4	Level 1 - Office	17,9	Space	User Defined	28,0	L/s	0,0	L/s	0,0	L/s
33	1.1.09 Office 5	Level 1 - Office	18,0	Space	User Defined	28,0	L/s	0,0	L/s	0,0	L/s
34	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office	18,2	Space	User Defined	83,0	L/s	0,0	L/s	83,0	L/s
35	1.1.11 Pantry (1)	Level 1 - Office	17,9	Space	User Defined	153,0	L/s	0,0	L/s	0,0	L/s
36	1.1.12 Storage Room (1)	Level 1 - Office	13,2	Space	User Defined	56,0	L/s	0,0	L/s	0,0	L/s
37	1.1.13 Control Room Filing	Level 1 - Tech FF	22,1	Space	User Defined	97,0	L/s	0,0	L/s	0,0	L/s

Index	Space	Level	Floor Area (sqm)	Space Type	Ventilation						
					ASHRAE Standard 62.1-2019 Space Usage	OA Requirement 1		OA Requirement 2		Direct Exhaust	
						Airflow	Units	Airflow	Units	Airflow	Units
38	1.1.14 Control Room Training	Level 1 - Tech FF	32,1	Space	User Defined	42,0	L/s	0,0	L/s	0,0	L/s
39	1.1.15 Control Room	Level 1 - Tech FF	341,7	Space	User Defined	194,0	L/s	0,0	L/s	0,0	L/s
40	1.1.16 Engineering Room	Level 1 - Tech FF	102,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
41	1.1.17 HVAC Room (1)	Level 1 - Office	72,3	Space	User Defined	67,0	L/s	0,0	L/s	67,0	L/s
42	1.1.17 HVAC Room (1)	Level 1 - Tech FF	153,6	Space	User Defined	100,0	L/s	0,0	L/s	100,0	L/s
43	1.1.18 Corridor (2)	Level 2 - Office	43,9	Space	User Defined	139,0	L/s	0,0	L/s	139,0	L/s
44	1.2.01 Marshaling Room	Level 0 - Tech FF	177,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
45	1.2.02 Auxiliary Room	Level 0 - Tech FF	151,8	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
46	1.2.03 Server Room	Level 0 - Tech FF	51,0	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
47	1.2.04 UPS Room	Level 0 - Tech FF	127,9	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s
48	1.2.05 Security Equipment Room	Level 0 - Tech FF	24,1	Space	User Defined	14,0	L/s	0,0	L/s	14,0	L/s
49	1.2.06 Battery Room	Level 0 - Tech	152,7	Space	User Defined	2 486,0	L/s	0,0	L/s	2 486,0	L/s
50	1.2.07 Machine Room	Level 2 - Office	35,9	Space	User Defined	28,0	L/s	0,0	L/s	28,0	L/s
51	1.2.08 Water Tanks	Level 2 - Office	88,2	Space	User Defined	167,0	L/s	0,0	L/s	167,0	L/s

2.2. Overhead Lighting and Daylighting Control

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
1	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
2	0.1.01 Corridor (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
3	0.1.02 Lobby (North)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
4	0.1.03 Lobby (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
5	0.1.04 Corridor (SW)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
6	0.1.05 Corridor (SE)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
7	0.1.06 Washroom (Senior Office)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
8	0.1.07 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
9	0.1.08 Toilets F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
10	0.1.09 Dinning Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
11	0.1.10 Kitchen / Tea Prep (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
12	0.1.11 Pantry (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
13	0.1.12 Prayer Room F	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
14	0.1.13 Muster Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
15	0.1.14 Senior Office	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
16	0.1.15 Office 1	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
17	0.1.16 Meeting Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
18	0.1.17 Storage (East)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
19	0.1.18 Storage (West)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
20	0.1.19 Storage (Stairs)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
21	0.1.20 Senior Store	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
22	0.1.21 Telecom Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
23	0.1.22 HVAC Room (0)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
24	0.1.23 GSM Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
25	1.1.01 Corridor (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
26	1.1.02 Lobby (Control Room)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
27	1.1.03 Toilets M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
28	1.1.04 Prayer Room M	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
29	1.1.05 Meeting Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
30	1.1.06 Office 2	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
31	1.1.07 Office 3	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
32	1.1.08 Office 4	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
33	1.1.09 Office 5	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
34	1.1.10 Kitchen / Tea Prep. (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
35	1.1.11 Pantry (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
36	1.1.12 Storage Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
37	1.1.13 Control Room Filing	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
38	1.1.14 Control Room Training	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
39	1.1.15 Control Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - CR Light	1,00	Not Used	---	---
40	1.1.16 Engineering Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
41	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
42	1.1.17 HVAC Room (1)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---

Index	Space	Overhead Lighting							Daylighting Control		
		ASHRAE Standard 90.1-2019		Power	Units	Lighting Type	Schedule	Power Multi.	Control Type	Illum. Setpoint	Units
		Lighting Method	Space Usage								
43	1.1.18 Corridor (2)	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Office Light	1,00	Not Used	---	---
44	1.2.01 Marshaling Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
45	1.2.02 Auxiliary Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
46	1.2.03 Server Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
47	1.2.04 UPS Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
48	1.2.05 Security Equipment Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
49	1.2.06 Battery Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
50	1.2.07 Machine Room	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---
51	1.2.08 Water Tanks	Building Area	User Defined	5,00	W/sqm	LED: Free Hanging	Schedule - Tech Light	1,00	Not Used	---	---

2.3. Task Lighting, Electric Equipment and Miscellaneous Heat Gain

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
1	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
2	0.1.01 Corridor (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
3	0.1.02 Lobby (North)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
4	0.1.03 Lobby (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
5	0.1.04 Corridor (SW)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
6	0.1.05 Corridor (SE)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
7	0.1.06 Washroom (Senior Office)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
8	0.1.07 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
9	0.1.08 Toilets F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
10	0.1.09 Dinning Room	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
11	0.1.10 Kitchen / Tea Prep (0)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
12	0.1.11 Pantry (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
13	0.1.12 Prayer Room F	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
14	0.1.13 Muster Room	0,00	W/sqm	(None)	195,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
15	0.1.14 Senior Office	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
16	0.1.15 Office 1	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
17	0.1.16 Meeting Room (0)	0,00	W/sqm	(None)	700,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
18	0.1.17 Storage (East)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
19	0.1.18 Storage (West)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
20	0.1.19 Storage (Stairs)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
21	0.1.20 Senior Store	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
22	0.1.21 Telecom Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
23	0.1.22 HVAC Room (0)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
24	0.1.23 GSM Room	0,00	W/sqm	(None)	2 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
25	1.1.01 Corridor (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
26	1.1.02 Lobby (Control Room)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
27	1.1.03 Toilets M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
28	1.1.04 Prayer Room M	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
29	1.1.05 Meeting Room (1)	0,00	W/sqm	(None)	500,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
30	1.1.06 Office 2	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
31	1.1.07 Office 3	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
32	1.1.08 Office 4	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
33	1.1.09 Office 5	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
34	1.1.10 Kitchen / Tea Prep. (1)	0,00	W/sqm	(None)	1 512,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
35	1.1.11 Pantry (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
36	1.1.12 Storage Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
37	1.1.13 Control Room Filing	0,00	W/sqm	(None)	95,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
38	1.1.14 Control Room Training	0,00	W/sqm	(None)	190,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
39	1.1.15 Control Room	0,00	W/sqm	(None)	775,0	Watts	Schedule - CR Equipment	0	(None)	0	(None)
40	1.1.16 Engineering Room	0,00	W/sqm	(None)	475,0	Watts	Schedule - Ofiice Equipment	0	(None)	0	(None)
41	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
42	1.1.17 HVAC Room (1)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
43	1.1.18 Corridor (2)	0,00	W/sqm	(None)	0,0	Watts	(None)	0	(None)	0	(None)
44	1.2.01 Marshaling Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
45	1.2.02 Auxiliary Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
46	1.2.03 Server Room	0,00	W/sqm	(None)	9 740,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

Index	Space	Task Lighting			Electric Equipment			Miscellaneous Heat Gain			
		Power	Units	Schedule	Power	Units	Schedule	Sens. (W)	Schedule	Latent (W)	Schedule
47	1.2.04 UPS Room	0,00	W/sqm	(None)	24 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
48	1.2.05 Security Equipment Room	0,00	W/sqm	(None)	5 000,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
49	1.2.06 Battery Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
50	1.2.07 Machine Room	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)
51	1.2.08 Water Tanks	0,00	W/sqm	(None)	500,0	Watts	Schedule - Tech Equipment	0	(None)	0	(None)

2.4. Occupancy and Infiltration

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
1	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
2	0.1.01 Corridor (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
3	0.1.02 Lobby (North)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
4	0.1.03 Lobby (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
5	0.1.04 Corridor (SW)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
6	0.1.05 Corridor (SE)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
7	0.1.06 Washroom (Senior Office)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
8	0.1.07 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
9	0.1.08 Toilets F	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
10	0.1.09 Dinning Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
11	0.1.10 Kitchen / Tea Prep (0)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
12	0.1.11 Pantry (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
13	0.1.12 Prayer Room F	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
14	0.1.13 Muster Room	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
15	0.1.14 Senior Office	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
16	0.1.15 Office 1	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
17	0.1.16 Meeting Room (0)	15	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
18	0.1.17 Storage (East)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
19	0.1.18 Storage (West)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
20	0.1.19 Storage (Stairs)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
21	0.1.20 Senior Store	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
22	0.1.21 Telecom Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
23	0.1.22 HVAC Room (0)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
24	0.1.23 GSM Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
25	1.1.01 Corridor (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
26	1.1.02 Lobby (Control Room)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
27	1.1.03 Toilets M	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
28	1.1.04 Prayer Room M	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
29	1.1.05 Meeting Room (1)	10	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
30	1.1.06 Office 2	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
31	1.1.07 Office 3	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
32	1.1.08 Office 4	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
33	1.1.09 Office 5	1	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
34	1.1.10 Kitchen / Tea Prep. (1)	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
35	1.1.11 Pantry (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
36	1.1.12 Storage Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
37	1.1.13 Control Room Filing	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
38	1.1.14 Control Room Training	2	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
39	1.1.15 Control Room	5	People	Schedule - CR People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
40	1.1.16 Engineering Room	5	People	Schedule - Office People	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
41	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
42	1.1.17 HVAC Room (1)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
43	1.1.18 Corridor (2)	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
44	1.2.01 Marshaling Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
45	1.2.02 Auxiliary Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
46	1.2.03 Server Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
47	1.2.04 UPS Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

Index	Space	Occupants						Infiltration				
		Occupancy	Units	Schedule	Activity Level	Sens. (W/person)	Latent (W/person)	Cooling Airflow	Heating Airflow	Simulation Airflow	Units	Occurs
48	1.2.05 Security Equipment Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
49	1.2.06 Battery Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
50	1.2.07 Machine Room	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours
51	1.2.08 Water Tanks	0	People	(None)	Office Work	71,8	60,1	0,00	0,00	0,00	ACH	All Hours

3. Zoning

Zone	Space	Level
0.1.01 Corridor (0)		
	0.1.01 Corridor (0)	Level 0 - Office
	0.1.01 Corridor (0)	Level 0 - Office Low
0.1.02 Lobby (North)		
	0.1.02 Lobby (North)	Level 0 - Office
0.1.03 Lobby (West)		
	0.1.03 Lobby (West)	Level 0 - Office Low
0.1.04 Corridor (SW)		
	0.1.04 Corridor (SW)	Level 0 - Tech
0.1.05 Corridor (SE)		
	0.1.05 Corridor (SE)	Level 0 - Tech FF
0.1.06 Washroom (Senior Office)		
	0.1.06 Washroom (Senior Office)	Level 0 - Office
0.1.07 Toilets M		
	0.1.07 Toilets M	Level 0 - Office
0.1.08 Toilets F		
	0.1.08 Toilets F	Level 0 - Office
0.1.09 Dinning Room		
	0.1.09 Dinning Room	Level 0 - Office
0.1.10 Kitchen / Tea Prep (0)		
	0.1.10 Kitchen / Tea Prep (0)	Level 0 - Office
0.1.11 Pantry (0)		
	0.1.11 Pantry (0)	Level 0 - Office
0.1.12 Prayer Room F		
	0.1.12 Prayer Room F	Level 0 - Office Low
0.1.13 Muster Room		

Zone	Space	Level
	0.1.13 Muster Room	Level 0 - Office
0.1.14 Senior Office		
	0.1.14 Senior Office	Level 0 - Office
0.1.15 Office 1		
	0.1.15 Office 1	Level 0 - Office
0.1.16 Meeting Room (0)		
	0.1.16 Meeting Room (0)	Level 0 - Office
0.1.17 Storage (East)		
	0.1.17 Storage (East)	Level 0 - Office
0.1.18 Storage (West)		
	0.1.18 Storage (West)	Level 0 - Office Low
0.1.19 Storage (Stairs)		
	0.1.19 Storage (Stairs)	Level 0 - Office
0.1.20 Senior Store		
	0.1.20 Senior Store	Level 0 - Office
0.1.21 Telecom Room		
	0.1.21 Telecom Room	Level 0 - Tech FF
0.1.22 HVAC Room (0)		
	0.1.22 HVAC Room (0)	Level 0 - Tech
0.1.23 GSM Room		
	0.1.23 GSM Room	Level 1 - Tech FF
1.1.01 Corridor (1)		
	1.1.01 Corridor (1)	Level 1 - Office
1.1.02 Lobby (Control Room)		
	1.1.02 Lobby (Control Room)	Level 1 - Tech FF
1.1.03 Toilets M		
	1.1.03 Toilets M	Level 1 - Office
1.1.04 Prayer Room M		

Zone	Space	Level
	1.1.04 Prayer Room M	Level 1 - Office
1.1.05 Meeting Room (1)		
	1.1.05 Meeting Room (1)	Level 1 - Office
1.1.06 Office 2		
	1.1.06 Office 2	Level 1 - Office
1.1.07 Office 3		
	1.1.07 Office 3	Level 1 - Office
1.1.08 Office 4		
	1.1.08 Office 4	Level 1 - Office
1.1.09 Office 5		
	1.1.09 Office 5	Level 1 - Office
1.1.10 Kitchen / Tea Prep. (1)		
	1.1.10 Kitchen / Tea Prep. (1)	Level 1 - Office
1.1.11 Pantry (1)		
	1.1.11 Pantry (1)	Level 1 - Office
1.1.12 Storage Room (1)		
	1.1.12 Storage Room (1)	Level 1 - Office
1.1.13 Control Room Filing		
	1.1.13 Control Room Filing	Level 1 - Tech FF
1.1.14 Control Room Training		
	1.1.14 Control Room Training	Level 1 - Tech FF
1.1.15 Control Room		
	1.1.15 Control Room	Level 1 - Tech FF
1.1.16 Engineering Room		
	1.1.16 Engineering Room	Level 1 - Tech FF
1.1.17 HVAC Room (1)		
	1.1.17 HVAC Room (1)	Level 1 - Office
	1.1.17 HVAC Room (1)	Level 1 - Tech FF

Zone	Space	Level
1.1.18 Corridor (2)		
	1.1.18 Corridor (2)	Level 2 - Office
1.2.01 Marshaling Room		
	1.2.01 Marshaling Room	Level 0 - Tech FF
1.2.02 Auxiliary Room		
	1.2.02 Auxiliary Room	Level 0 - Tech FF
1.2.03 Server Room		
	1.2.03 Server Room	Level 0 - Tech FF
1.2.04 UPS Room		
	1.2.04 UPS Room	Level 0 - Tech FF
1.2.05 Security Equipment Room		
	1.2.05 Security Equipment Room	Level 0 - Tech FF
1.2.06 Battery Room		
	1.2.06 Battery Room	Level 0 - Tech
1.2.07 Machine Room		
	1.2.07 Machine Room	Level 2 - Office
1.2.08 Water Tanks		
	1.2.08 Water Tanks	Level 2 - Office
Unconditioned (no spaces)		
Unassigned (no spaces)		

4. Assemblies

Category	Surface Group	Selected Assembly
Exterior Above Grade Wall		
	Wall External	HVAC - Wall Exterior - Above grade
	Wall Internal	HVAC - Wall Exterior - Above grade
Exterior Below Grade Wall		
	Wall External	HVAC - Wall Exterior - Below grade
	Wall Internal	HVAC - Wall Exterior - Below grade
Interior Wall		
	Wall External	Wall Interior
	Wall Internal	Wall Interior
Roof		
	Default	HVAC - Roof
Ceiling		
	Interior Ceilings	Acoustic Tile Ceiling
Floor Above Space		
	Interior Floors Above Space	Floor interior
	Raised Floors	False Floor
Slab Floor On Grade		
	At-Grade Floors	HVAC - Floor exterior - On grade
Slab Floor Below Grade		
	Below Grade Floors	HVAC - Floor exterior - Below grade

5. Windows & Doors

Category	Tag	Width x Height, Elevation	Selected Assembly
Window			
	Door FF	2000 mm x 2000 mm, 1000 mm	Door FF
	Door FF Single	1000 mm x 2000 mm, 1000 mm	Door FF
	Window 1x1	1000 mm x 1200 mm, 1000 mm	Window
	Window Toilet 4x0,7	4000 mm x 700 mm, 1500 mm	Door FF
	Window Toilet 1x0,7	1000 mm x 700 mm, 1500 mm	Window
Door			
	Door Double	2000 mm x 2000 mm	Door
	Door Single	1000 mm x 2000 mm	Door

ASHRAE 90.1 Vertical Glazing Summary:

Total Window Opening Glazing Area	59,8	sqm
Total Door Opening Glazing Area	0,0	sqm
Total Gross Above Grade Wall Area	2436,5	sqm
Window-to-wall Ratio (WWR)	2,3	%

Civil - Control Building - AHU 0.1 (Offices 0) Input Data

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 13:08

1. General Details:

Air System Name ..... **Civil - Control Building - AHU 0.1 (Offices 0)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **Civil - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **13,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **18,3** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:
Assigned Zones:

Zone	Zone Name
1	0.1.01 Corridor (0)
2	0.1.02 Lobby (North)
3	0.1.03 Lobby (West)
4	0.1.04 Corridor (SW)
5	0.1.05 Corridor (SE)
6	0.1.06 Washroom (Senior Office)
7	0.1.07 Toilets M
8	0.1.08 Toilets F
9	0.1.09 Dinning Room
10	0.1.10 Kitchen / Tea Prep (0)
11	0.1.11 Pantry (0)
12	0.1.12 Prayer Room F
13	0.1.13 Muster Room
14	0.1.14 Senior Office
15	0.1.15 Office 1
16	0.1.16 Meeting Room (0)
17	0.1.17 Storage (East)
18	0.1.18 Storage (West)
19	0.1.19 Storage (Stairs)
20	0.1.20 Senior Store
21	0.1.21 HVAC Room (0)

Number of zones **21**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	100	0,0
2	25,6	25,6	21,0	21,0	0,83	100	0,0
3	25,6	25,6	21,0	21,0	0,83	100	0,0
4	25,6	25,6	21,0	21,0	0,83	100	0,0
5	25,6	25,6	21,0	21,0	0,83	100	0,0
6	25,6	25,6	21,0	21,0	0,83	100	0,0
7	25,6	25,6	21,0	21,0	0,83	100	0,0
8	25,6	25,6	21,0	21,0	0,83	100	0,0
9	24,0	24,0	21,0	21,0	0,83	100	0,0
10	24,0	24,0	21,0	21,0	0,83	100	0,0
11	24,0	24,0	21,0	21,0	0,83	100	0,0
12	24,0	24,0	21,0	21,0	0,83	100	0,0
13	24,0	24,0	21,0	21,0	0,83	100	0,0
14	24,0	24,0	21,0	21,0	0,83	100	0,0
15	24,0	24,0	21,0	21,0	0,83	100	0,0
16	24,0	24,0	21,0	21,0	0,83	100	0,0
17	25,6	25,6	21,0	21,0	0,83	100	0,0
18	25,6	25,6	21,0	21,0	0,83	100	0,0
19	25,6	25,6	21,0	21,0	0,83	100	0,0
20	25,6	25,6	21,0	21,0	0,83	100	0,0
21	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
3	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
4	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
5	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
6	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
7	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
8	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
9	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
10	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
11	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
12	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
13	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
14	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
15	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
16	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
17	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
18	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
19	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
20	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
21	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **4373,2** L/s
Ventilation Airflow ..... **2280,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature **6,7** C
Chilled Water Delta-T **5,6** K
Hot Water Supply Temperature **60,0** C
Hot Water Delta-T **11,1** K

Safety Factors:

Cooling Sensible **10** %
Cooling Latent **10** %
Heating **10** %

Zone Sizing Data:

Zone Airflow Sizing Method **Peak zone sensible load**
Space Airflow Sizing Method **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	145,9	-	3,3	-
2	167,0	-	3,8	-
3	111,0	-	2,5	-
4	121,3	-	2,7	-
5	111,0	-	2,5	-
6	56,0	-	1,3	-
7	181,0	-	4,1	-
8	167,0	-	3,8	-
9	247,6	-	3,8	-
10	216,4	-	1,9	-
11	153,0	-	3,5	-
12	303,6	-	1,9	-
13	458,8	-	3,5	-
14	194,8	-	1,3	-
15	99,3	-	0,7	-
16	386,2	-	4,7	-
17	56,8	-	1,3	-
18	69,0	-	1,6	-
19	45,8	-	0,9	-
20	54,4	-	0,9	-
21	1098,9	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **173,0** kW
Design OADB **51,7** C
Design EWB **26,0** C
Equipment Sizing **(Auto-Sized) 171,7** kW
Capacity Oversizing Factor **0** %
AHRI Performance Rating **2,500** EER
DX System Configuration **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT **-17,8** C

1. General Details:

Air System Name ..... **Civil - Control Building - AHU 0.2 (Telecom)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **Civil - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **15,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **20,0** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.2.01 Telecom Room
2	0.2.02 GSM Room

Number of zones **2**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	20,0	20,0	16,0	16,0	0,83	100	0,0
2	20,0	20,0	16,0	16,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **4310,4** L/s
Ventilation Airflow ..... **181,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	3295,2	-	3,8	-
2	1051,2	-	0,3	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **51,8** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 51,4** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **Civil - Control Building - AHU 0.3 (Battery)**
Equipment Type ..... **Split AHU**
Air System Type ..... **Single Zone CAV**
Space Model: ..... **Civil - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Central Cooling Data:

Supply Airflow Rate ..... **2486,0** L/s
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %
Fan Control ..... **1-speed, cooling and heating**

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.3 Battery Room

Number of zones **1**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	Diffuser (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **24,3** C
Supply Fan Airflow ..... **2486,0** L/s
Ventilation Airflow ..... **2486,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	2486,0	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **119,2** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 118,3** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **Civil - Control Building - AHU 1.1 (Offices 1)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **Civil - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **15,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **18,3** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.1.01 Corridor (1)
2	1.1.02 Lobby (Control Room)
3	1.1.03 Toilets M
4	1.1.04 Prayer Room M
5	1.1.05 Meeting Room (1)
6	1.1.06 Office 2
7	1.1.07 Office 3
8	1.1.08 Office 4
9	1.1.09 Office 5
10	1.1.10 Kitchen / Tea Prep. (1)
11	1.1.11 Pantry (1)
12	1.1.12 Storage Room (1)
13	1.1.13 Control Room Filing
14	1.1.14 Control Room Training
15	1.1.15 Control Room
16	1.1.16 Engineering Room
17	1.1.17 HVAC Room (1)
18	1.1.18 Corridor (2)

Number of zones **18**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,4	25,4	21,0	21,0	0,83	100	0,0
2	25,4	25,4	21,0	21,0	0,83	100	0,0
3	25,4	25,4	21,0	21,0	0,83	100	0,0
4	24,0	24,0	21,0	21,0	0,83	100	0,0
5	24,0	24,0	21,0	21,0	0,83	100	0,0
6	24,0	24,0	21,0	21,0	0,83	100	0,0
7	24,0	24,0	21,0	21,0	0,83	100	0,0
8	24,0	24,0	21,0	21,0	0,83	100	0,0
9	24,0	24,0	21,0	21,0	0,83	100	0,0
10	24,0	24,0	21,0	21,0	0,83	100	0,0
11	24,0	24,0	21,0	21,0	0,83	100	0,0
12	25,4	25,4	21,0	21,0	0,83	100	0,0
13	25,4	25,4	21,0	21,0	0,83	100	0,0
14	24,0	24,0	21,0	21,0	0,83	100	0,0
15	24,0	24,0	21,0	21,0	0,83	100	0,0
16	24,0	24,0	21,0	21,0	0,83	100	0,0
17	25,4	25,4	5,0	5,0	0,83	100	0,0
18	25,4	25,4	21,0	21,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
3	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
4	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
5	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
6	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
7	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
8	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
9	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
10	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
11	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
12	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
13	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
14	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
15	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
16	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
17	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
18	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **7513,0** L/s
Ventilation Airflow ..... **2585,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %

Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	715,1	-	8,2	-
2	167,0	-	3,8	-
3	486,0	-	11,0	-
4	290,6	-	3,1	-
5	368,0	-	3,5	-
6	129,9	-	0,9	-
7	128,4	-	0,9	-
8	127,7	-	0,9	-
9	129,2	-	0,9	-
10	241,3	-	1,9	-
11	153,0	-	3,5	-
12	76,4	-	1,3	-
13	97,0	-	2,2	-
14	285,5	-	1,8	-
15	1573,4	-	9,9	-
16	863,0	-	5,0	-
17	1305,0	-	-	-
18	461,1	-	4,9	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **225,6** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 223,8** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **Civil - Control Building - AHU 1.2 (Tech)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **Civil - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **20,0** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.2.01 Marshaling Room
2	1.2.02 Auxiliary Room
3	1.2.03 Server Room
4	1.2.04 UPS Room
5	1.2.05 Security Equipment Room
6	1.2.07 Machine Room
7	1.2.08 Water Tanks

Number of zones **7**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	5,0	5,0	0,83	100	0,0
2	25,6	25,6	5,0	5,0	0,83	100	0,0
3	25,6	25,6	5,0	5,0	0,83	100	0,0
4	25,6	25,6	5,0	5,0	0,83	100	0,0
5	25,6	25,6	5,0	5,0	0,83	100	0,0
6	25,6	25,6	5,0	5,0	0,83	100	0,0
7	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
2	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
3	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
4	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
5	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
6	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
7	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **6576,3** L/s
Ventilation Airflow ..... **877,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	982,3	-	-	-
2	670,2	-	-	-
3	1037,6	-	-	-
4	2436,4	-	-	-
5	465,7	-	-	-
6	257,5	-	-	-

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
7	760,3	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load		**127,7**	kW
Design OADB		**51,7**	C
Design EWB		**26,0**	C
Equipment Sizing	**(Auto-Sized)**	**126,7**	kW
Capacity Oversizing Factor		**0**	%
AHRI Performance Rating		**2,500**	EER
DX System Configuration	**1-stage, 1 compressor, 1 circuit**		
Low Temperature Cutoff OAT		**-17,8**	C

HVAC - Control Building - AHU 0.1 (Offices 0) Input Data

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 13:09

1. General Details:

Air System Name ..... **HVAC - Control Building - AHU 0.1 (Offices 0)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **HVAC - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **13,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **18,3** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.1.01 Corridor (0)
2	0.1.02 Lobby (North)
3	0.1.03 Lobby (West)
4	0.1.04 Corridor (SW)
5	0.1.05 Corridor (SE)
6	0.1.06 Washroom (Senior Office)
7	0.1.07 Toilets M
8	0.1.08 Toilets F
9	0.1.09 Dinning Room
10	0.1.10 Kitchen / Tea Prep (0)
11	0.1.11 Pantry (0)
12	0.1.12 Prayer Room F
13	0.1.13 Muster Room
14	0.1.14 Senior Office
15	0.1.15 Office 1
16	0.1.16 Meeting Room (0)
17	0.1.17 Storage (East)
18	0.1.18 Storage (West)
19	0.1.19 Storage (Stairs)
20	0.1.20 Senior Store
21	0.1.21 HVAC Room (0)

Number of zones **21**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	100	0,0
2	25,6	25,6	21,0	21,0	0,83	100	0,0
3	25,6	25,6	21,0	21,0	0,83	100	0,0
4	25,6	25,6	21,0	21,0	0,83	100	0,0
5	25,6	25,6	21,0	21,0	0,83	100	0,0
6	25,6	25,6	21,0	21,0	0,83	100	0,0
7	25,6	25,6	21,0	21,0	0,83	100	0,0
8	25,6	25,6	21,0	21,0	0,83	100	0,0
9	24,0	24,0	21,0	21,0	0,83	100	0,0
10	24,0	24,0	21,0	21,0	0,83	100	0,0
11	24,0	24,0	21,0	21,0	0,83	100	0,0
12	24,0	24,0	21,0	21,0	0,83	100	0,0
13	24,0	24,0	21,0	21,0	0,83	100	0,0
14	24,0	24,0	21,0	21,0	0,83	100	0,0
15	24,0	24,0	21,0	21,0	0,83	100	0,0
16	24,0	24,0	21,0	21,0	0,83	100	0,0
17	25,6	25,6	21,0	21,0	0,83	100	0,0
18	25,6	25,6	21,0	21,0	0,83	100	0,0
19	25,6	25,6	21,0	21,0	0,83	100	0,0
20	25,6	25,6	21,0	21,0	0,83	100	0,0
21	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
3	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
4	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
5	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
6	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
7	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
8	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
9	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
10	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
11	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
12	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
13	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
14	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
15	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
16	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
17	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
18	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
19	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
20	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
21	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **2869,4** L/s
Ventilation Airflow ..... **2280,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	83,0	-	1,9	-
2	167,0	-	3,8	-
3	111,0	-	2,5	-
4	111,0	-	2,5	-
5	111,0	-	2,5	-
6	56,0	-	1,3	-
7	181,0	-	4,1	-
8	167,0	-	3,8	-
9	174,3	-	3,8	-
10	174,4	-	1,9	-
11	153,0	-	3,5	-
12	124,6	-	1,9	-
13	244,8	-	3,5	-
14	118,6	-	0,9	-
15	60,6	-	0,6	-
16	263,4	-	4,7	-
17	56,0	-	1,3	-
18	69,0	-	1,6	-
19	42,0	-	0,9	-
20	42,0	-	0,9	-
21	452,6	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **140,5** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 139,4** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **HVAC - Control Building - AHU 0.2 (Telecom)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **HVAC - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **15,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **20,0** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.2.01 Telecom Room
2	0.2.02 GSM Room

Number of zones **2**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	20,0	20,0	16,0	16,0	0,83	100	0,0
2	20,0	20,0	16,0	16,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **3385,0** L/s
Ventilation Airflow ..... **181,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	2674,2	-	3,8	-
2	710,9	-	0,3	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **42,9** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 42,6** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **HVAC - Control Building - AHU 0.3 (Battery)**
Equipment Type ..... **Split AHU**
Air System Type ..... **Single Zone CAV**
Space Model: ..... **HVAC - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Central Cooling Data:

Supply Airflow Rate ..... **2486,0** L/s
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %
Fan Control ..... **1-speed, cooling and heating**

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.3 Battery Room

Number of zones **1**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	Diffuser (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **25,0** C
Supply Fan Airflow ..... **2486,0** L/s
Ventilation Airflow ..... **2486,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	2486,0	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **119,2** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 118,3** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **HVAC - Control Building - AHU 1.1 (Offices 1)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **HVAC - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Preheat Coil Data:

Setpoint ..... **15,0** C
Heating Source ..... **Electric Resistance**
Schedule ..... **JFMAMJJASOND**
Coil position ..... **Downstream of Mixing Point**

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **18,3** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.1.01 Corridor (1)
2	1.1.02 Lobby (Control Room)
3	1.1.03 Toilets M
4	1.1.04 Prayer Room M
5	1.1.05 Meeting Room (1)
6	1.1.06 Office 2
7	1.1.07 Office 3
8	1.1.08 Office 4
9	1.1.09 Office 5
10	1.1.10 Kitchen / Tea Prep. (1)
11	1.1.11 Pantry (1)
12	1.1.12 Storage Room (1)
13	1.1.13 Control Room Filing
14	1.1.14 Control Room Training
15	1.1.15 Control Room
16	1.1.16 Engineering Room
17	1.1.17 HVAC Room (1)
18	1.1.18 Corridor (2)

Number of zones **18**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,4	25,4	21,0	21,0	0,83	100	0,0
2	25,4	25,4	21,0	21,0	0,83	100	0,0
3	25,4	25,4	21,0	21,0	0,83	100	0,0
4	24,0	24,0	21,0	21,0	0,83	100	0,0
5	24,0	24,0	21,0	21,0	0,83	100	0,0
6	24,0	24,0	21,0	21,0	0,83	100	0,0
7	24,0	24,0	21,0	21,0	0,83	100	0,0
8	24,0	24,0	21,0	21,0	0,83	100	0,0
9	24,0	24,0	21,0	21,0	0,83	100	0,0
10	24,0	24,0	21,0	21,0	0,83	100	0,0
11	24,0	24,0	21,0	21,0	0,83	100	0,0
12	25,4	25,4	21,0	21,0	0,83	100	0,0
13	25,4	25,4	21,0	21,0	0,83	100	0,0
14	24,0	24,0	21,0	21,0	0,83	100	0,0
15	24,0	24,0	21,0	21,0	0,83	100	0,0
16	24,0	24,0	21,0	21,0	0,83	100	0,0
17	25,4	25,4	5,0	5,0	0,83	100	0,0
18	25,4	25,4	21,0	21,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
2	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
3	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
4	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
5	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
6	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
7	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
8	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
9	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
10	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
11	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
12	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
13	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
14	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
15	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
16	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-
17	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
18	VAV box with RH (Dual Maximum)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	35,0 C	-	-

Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **4242,5** L/s
Ventilation Airflow ..... **2585,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %

Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	361,0	-	8,2	-
2	167,0	-	3,8	-
3	486,0	-	11,0	-
4	180,7	-	3,1	-
5	238,2	-	3,5	-
6	76,6	-	0,6	-
7	75,5	-	0,6	-
8	75,3	-	0,6	-
9	76,4	-	0,6	-
10	185,6	-	1,9	-
11	153,0	-	3,5	-
12	56,0	-	1,3	-
13	97,0	-	2,2	-
14	128,2	-	0,9	-
15	948,8	-	4,8	-
16	388,6	-	3,8	-
17	464,4	-	-	-
18	168,9	-	3,8	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load ..... **193,7** kW
Design OADB ..... **51,7** C
Design EWB ..... **26,0** C
Equipment Sizing ..... **(Auto-Sized) 192,3** kW
Capacity Oversizing Factor ..... **0** %
AHRI Performance Rating ..... **2,500** EER
DX System Configuration ..... **1-stage, 1 compressor, 1 circuit**
Low Temperature Cutoff OAT ..... **-17,8** C

1. General Details:

Air System Name ..... **HVAC - Control Building - AHU 1.2 (Tech)**
Equipment Type ..... **Split AHU**
Air System Type ..... **VAV**
Space Model: ..... **HVAC - Control Building**
Notes:

2. System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**
Unocc. Damper Position ..... **Closed**
Damper Leak Rate ..... **0** %

Central Cooling Data:

Supply Air Temperature ..... **16,0** C
Cooling Source ..... **Air-Cooled DX**
Schedule ..... **JFMAMJJASOND**
Capacity Control ..... **Temperature Reset by Greatest Zone Demand**
Max. Supply Temperature ..... **20,0** C

Supply Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Room) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Room) ..... **60** %
Dehumidification Reheat Source ..... **Electric Resistance**

Duct System Data:

Supply Duct Data:

Duct Leakage ..... **0** %

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.2.01 Marshaling Room
2	1.2.02 Auxiliary Room
3	1.2.03 Server Room
4	1.2.04 UPS Room
5	1.2.05 Security Equipment Room
6	1.2.07 Machine Room
7	1.2.08 Water Tanks

Number of zones **7**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	5,0	5,0	0,83	100	0,0
2	25,6	25,6	5,0	5,0	0,83	100	0,0
3	25,6	25,6	5,0	5,0	0,83	100	0,0
4	25,6	25,6	5,0	5,0	0,83	100	0,0
5	25,6	25,6	5,0	5,0	0,83	100	0,0
6	25,6	25,6	5,0	5,0	0,83	100	0,0
7	25,6	25,6	5,0	5,0	0,83	100	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Supply Terminals Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
1	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
2	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
3	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
4	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
5	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
6	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-
7	VAV box (no reheat)	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	-	-

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **16,0** C
Supply Fan Airflow ..... **5347,1** L/s
Ventilation Airflow ..... **877,0** L/s

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,7** C
Chilled Water Delta-T ..... **5,6** K
Hot Water Supply Temperature ..... **60,0** C
Hot Water Delta-T ..... **11,1** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
1	643,2	-	-	-
2	561,4	-	-	-
3	952,3	-	-	-
4	2298,2	-	-	-
5	455,3	-	-	-
6	141,8	-	-	-

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	FPMBX Fan (L/s)
7	319,1	-	-	-

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load		**111,2**	kW
Design OADB		**51,7**	C
Design EWB		**26,0**	C
Equipment Sizing	**(Auto-Sized)**	**110,4**	kW
Capacity Oversizing Factor		**0**	%
AHRI Performance Rating		**2,500**	EER
DX System Configuration	**1-stage, 1 compressor, 1 circuit**		
Low Temperature Cutoff OAT		**-17,8**	C

IPS - Control Building - FAHU 0.1 (Offices 0) Input Data

Project: Calculations 10-05-2025
Prepared by: IPS 11:53

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 0.1 (Offices 0)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **4-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Air-to-Air Energy Recovery Data:

Recovery Type ..... **Sensible and Latent Heat**
Thermal Efficiency ..... **40** %
Input kW ..... **0,900** kW
Schedule ..... **JFMAMJJASOND**

Cooling Coil Data:

Setpoint ..... **24,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil Data:

Setpoint ..... **21,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Return Air Plenum**

Exhaust Fan Data:

Fan Type ..... **Forward Curved**
Fan Performance ..... **500** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.1.01 Corridor (0)
2	0.1.02 Lobby (North)
3	0.1.03 Lobby (West)
4	0.1.04 Corridor (SW)
5	0.1.05 Corridor (SE)
6	0.1.06 Washroom (Senior Office)
7	0.1.07 Toilets M
8	0.1.08 Toilets F
9	0.1.09 Dinning Room
10	0.1.10 Kitchen / Tea Prep (0)
11	0.1.11 Pantry (0)
12	0.1.12 Prayer Room F
13	0.1.13 Muster Room
14	0.1.14 Senior Office
15	0.1.15 Office 1
16	0.1.16 Meeting Room (0)
17	0.1.17 Storage (East)
18	0.1.18 Storage (West)
19	0.1.19 Storage (Stairs)
20	0.1.20 Senior Store
21	0.1.21 Telecom Room
22	0.1.22 HVAC Room (0)
23	0.1.23 GSM Room

Number of zones **23**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	n/a	0,0
2	25,6	25,6	21,0	21,0	0,83	n/a	0,0
3	25,6	25,6	21,0	21,0	0,83	n/a	0,0
4	25,6	25,6	21,0	21,0	0,83	n/a	0,0
5	25,6	25,6	21,0	21,0	0,83	n/a	0,0
6	25,6	25,6	21,0	21,0	0,83	n/a	0,0
7	25,6	25,6	21,0	21,0	0,83	n/a	0,0
8	25,6	25,6	21,0	21,0	0,83	n/a	0,0
9	24,0	24,0	21,0	21,0	0,83	n/a	0,0
10	24,0	24,0	21,0	21,0	0,83	n/a	0,0
11	24,0	24,0	21,0	21,0	0,83	n/a	0,0
12	24,0	24,0	21,0	21,0	0,83	n/a	0,0
13	24,0	24,0	21,0	21,0	0,83	n/a	0,0
14	24,0	24,0	21,0	21,0	0,83	n/a	0,0
15	24,0	24,0	21,0	21,0	0,83	n/a	0,0
16	24,0	24,0	21,0	21,0	0,83	n/a	0,0
17	25,6	25,6	21,0	21,0	0,83	n/a	0,0
18	25,6	25,6	21,0	21,0	0,83	n/a	0,0
19	25,6	25,6	21,0	21,0	0,83	n/a	0,0
20	25,6	25,6	21,0	21,0	0,83	n/a	0,0
21	20,0	20,0	16,0	16,0	0,83	n/a	0,0
22	25,6	25,6	5,0	5,0	0,83	n/a	0,0
23	20,0	20,0	16,0	16,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:

Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:

Design Supply Temp. ..... **35,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %
Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	60 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C
Heating Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 1.1 (Offices 1)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **4-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Air-to-Air Energy Recovery Data:

Recovery Type ..... **Sensible and Latent Heat**
Thermal Efficiency ..... **40** %
Input kW ..... **0,900** kW
Schedule ..... **JFMAMJJASOND**

Cooling Coil Data:

Setpoint ..... **24,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil Data:

Setpoint ..... **21,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Return Air Plenum**

Exhaust Fan Data:

Fan Type ..... **Forward Curved**
Fan Performance ..... **500** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.1.01 Corridor (1)
2	1.1.02 Lobby (Control Room)
3	1.1.03 Toilets M
4	1.1.04 Prayer Room M
5	1.1.05 Meeting Room (1)
6	1.1.06 Office 2
7	1.1.07 Office 3
8	1.1.08 Office 4
9	1.1.09 Office 5
10	1.1.10 Kitchen / Tea Prep. (1)
11	1.1.11 Pantry (1)
12	1.1.12 Storage Room (1)
13	1.1.13 Control Room Filing
14	1.1.14 Control Room Training
15	1.1.15 Control Room
16	1.1.16 Engineering Room
17	1.1.17 HVAC Room (1)
18	1.1.18 Corridor (2)

Number of zones **18**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	n/a	0,0
2	25,6	25,6	21,0	21,0	0,83	n/a	0,0
3	25,6	25,6	21,0	21,0	0,83	n/a	0,0
4	24,0	24,0	21,0	21,0	0,83	n/a	0,0
5	24,0	24,0	21,0	21,0	0,83	n/a	0,0
6	24,0	24,0	21,0	21,0	0,83	n/a	0,0
7	24,0	24,0	21,0	21,0	0,83	n/a	0,0
8	24,0	24,0	21,0	21,0	0,83	n/a	0,0
9	24,0	24,0	21,0	21,0	0,83	n/a	0,0
10	24,0	24,0	21,0	21,0	0,83	n/a	0,0
11	24,0	24,0	21,0	21,0	0,83	n/a	0,0
12	25,6	25,6	21,0	21,0	0,83	n/a	0,0
13	25,6	25,6	21,0	21,0	0,83	n/a	0,0
14	24,0	24,0	21,0	21,0	0,83	n/a	0,0
15	24,0	24,0	21,0	21,0	0,83	n/a	0,0
16	24,0	24,0	21,0	21,0	0,83	n/a	0,0
17	25,6	25,6	5,0	5,0	0,83	n/a	0,0
18	25,6	25,6	21,0	21,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:
Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:
Design Supply Temp. ..... **35,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %

Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	62 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C
Heating Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 1.2 (Tech)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **2-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Cooling Coil Data:

Setpoint ..... **25,6** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil Data:

Setpoint ..... **14,5** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.2.01 Marshaling Room
2	1.2.02 Auxiliary Room
3	1.2.03 Server Room
4	1.2.04 UPS Room
5	1.2.05 Security Equipment Room
6	1.2.06 Battery Room
7	1.2.07 Machine Room
8	1.2.08 Water Tanks

Number of zones **8**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
All	25,6	25,6	5,0	5,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:

Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:

Not Used

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %
Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	62 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

IPS - Control Building - FAHU 0.1 (Offices 0) Input Data

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 13:09

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 0.1 (Offices 0)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **4-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Air-to-Air Energy Recovery Data:

Recovery Type ..... **Sensible and Latent Heat**
Thermal Efficiency ..... **40** %
Input kW ..... **0,900** kW
Schedule ..... **JFMAMJJASOND**

Cooling Coil Data:

Setpoint ..... **24,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil Data:

Setpoint ..... **21,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Return Air Plenum**

Exhaust Fan Data:

Fan Type ..... **Forward Curved**
Fan Performance ..... **500** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	0.1.01 Corridor (0)
2	0.1.02 Lobby (North)
3	0.1.03 Lobby (West)
4	0.1.04 Corridor (SW)
5	0.1.05 Corridor (SE)
6	0.1.06 Washroom (Senior Office)
7	0.1.07 Toilets M
8	0.1.08 Toilets F
9	0.1.09 Dinning Room
10	0.1.10 Kitchen / Tea Prep (0)
11	0.1.11 Pantry (0)
12	0.1.12 Prayer Room F
13	0.1.13 Muster Room
14	0.1.14 Senior Office
15	0.1.15 Office 1
16	0.1.16 Meeting Room (0)
17	0.1.17 Storage (East)
18	0.1.18 Storage (West)
19	0.1.19 Storage (Stairs)
20	0.1.20 Senior Store
21	0.1.21 Telecom Room
22	0.1.22 HVAC Room (0)
23	0.1.23 GSM Room

Number of zones **23**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	n/a	0,0
2	25,6	25,6	21,0	21,0	0,83	n/a	0,0
3	25,6	25,6	21,0	21,0	0,83	n/a	0,0
4	25,6	25,6	21,0	21,0	0,83	n/a	0,0
5	25,6	25,6	21,0	21,0	0,83	n/a	0,0
6	25,6	25,6	21,0	21,0	0,83	n/a	0,0
7	25,6	25,6	21,0	21,0	0,83	n/a	0,0
8	25,6	25,6	21,0	21,0	0,83	n/a	0,0
9	24,0	24,0	21,0	21,0	0,83	n/a	0,0
10	24,0	24,0	21,0	21,0	0,83	n/a	0,0
11	24,0	24,0	21,0	21,0	0,83	n/a	0,0
12	24,0	24,0	21,0	21,0	0,83	n/a	0,0
13	24,0	24,0	21,0	21,0	0,83	n/a	0,0
14	24,0	24,0	21,0	21,0	0,83	n/a	0,0
15	24,0	24,0	21,0	21,0	0,83	n/a	0,0
16	24,0	24,0	21,0	21,0	0,83	n/a	0,0
17	25,6	25,6	21,0	21,0	0,83	n/a	0,0
18	25,6	25,6	21,0	21,0	0,83	n/a	0,0
19	25,6	25,6	21,0	21,0	0,83	n/a	0,0
20	25,6	25,6	21,0	21,0	0,83	n/a	0,0
21	20,0	20,0	16,0	16,0	0,83	n/a	0,0
22	25,6	25,6	5,0	5,0	0,83	n/a	0,0
23	20,0	20,0	16,0	16,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:

Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:

Design Supply Temp. ..... **35,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %
Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	60 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C
Heating Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 1.1 (Offices 1)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **4-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Air-to-Air Energy Recovery Data:

Recovery Type ..... **Sensible and Latent Heat**
Thermal Efficiency ..... **40** %
Input kW ..... **0,900** kW
Schedule ..... **JFMAMJJASOND**

Cooling Coil Data:

Setpoint ..... **24,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil Data:

Setpoint ..... **21,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Return Air Plenum**

Exhaust Fan Data:

Fan Type ..... **Forward Curved**
Fan Performance ..... **500** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.1.01 Corridor (1)
2	1.1.02 Lobby (Control Room)
3	1.1.03 Toilets M
4	1.1.04 Prayer Room M
5	1.1.05 Meeting Room (1)
6	1.1.06 Office 2
7	1.1.07 Office 3
8	1.1.08 Office 4
9	1.1.09 Office 5
10	1.1.10 Kitchen / Tea Prep. (1)
11	1.1.11 Pantry (1)
12	1.1.12 Storage Room (1)
13	1.1.13 Control Room Filing
14	1.1.14 Control Room Training
15	1.1.15 Control Room
16	1.1.16 Engineering Room
17	1.1.17 HVAC Room (1)
18	1.1.18 Corridor (2)

Number of zones **18**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
1	25,6	25,6	21,0	21,0	0,83	n/a	0,0
2	25,6	25,6	21,0	21,0	0,83	n/a	0,0
3	25,6	25,6	21,0	21,0	0,83	n/a	0,0
4	24,0	24,0	21,0	21,0	0,83	n/a	0,0
5	24,0	24,0	21,0	21,0	0,83	n/a	0,0
6	24,0	24,0	21,0	21,0	0,83	n/a	0,0
7	24,0	24,0	21,0	21,0	0,83	n/a	0,0
8	24,0	24,0	21,0	21,0	0,83	n/a	0,0
9	24,0	24,0	21,0	21,0	0,83	n/a	0,0
10	24,0	24,0	21,0	21,0	0,83	n/a	0,0
11	24,0	24,0	21,0	21,0	0,83	n/a	0,0
12	25,6	25,6	21,0	21,0	0,83	n/a	0,0
13	25,6	25,6	21,0	21,0	0,83	n/a	0,0
14	24,0	24,0	21,0	21,0	0,83	n/a	0,0
15	24,0	24,0	21,0	21,0	0,83	n/a	0,0
16	24,0	24,0	21,0	21,0	0,83	n/a	0,0
17	25,6	25,6	5,0	5,0	0,83	n/a	0,0
18	25,6	25,6	21,0	21,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:
Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:
Design Supply Temp. ..... **35,0** C
Heating Source ..... **Hot Water**
Schedule ..... **JFMAMJJASOND**

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %

Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	62 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C
Heating Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

1. General Details:

Air System Name ..... **IPS - Control Building - FAHU 1.2 (Tech)**
Equipment Type ..... **Terminal Units**
Air System Type ..... **2-Pipe Fan Coil**
Space Model: ..... **IPS - Control Building**
Ventilation ..... **DOAS (Air Direct to Spaces)**
Notes:

2. Dedicated Outdoor Air System Components:

Ventilation Air Data:

Airflow Control ..... **Constant Ventilation Airflow**
Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Cooling Coil Data:

Setpoint ..... **25,6** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Ventilation Fan Data:

Fan Type ..... **Forward Curved**
Configuration ..... **Draw-thru**
Fan Performance ..... **1000** Pa
Overall Efficiency ..... **60** %

% Airflow	100	90	80	70	60	50
% kW	100	91	81	72	61	54

% Airflow	40	30	20	10	0
% kW	46	40	33	27	21

Humidification Data:

Min. RH Setpoint (Discharge) ..... **50** %
Humidifier Type ..... **Self-contained Steam - Electric**
Input Power ..... **0,721** kWh/kg

Dehumidification Data:

Max. RH Setpoint (Discharge) ..... **60** %
Dehumidification Reheat Source ..... **Hot Water**

Duct System Data:

Return Duct or Plenum Data:

Return Air Via ..... **Ducted Return**

3. Zone Components:

Assigned Zones:

Zone	Zone Name
1	1.2.01 Marshaling Room
2	1.2.02 Auxiliary Room
3	1.2.03 Server Room
4	1.2.04 UPS Room
5	1.2.05 Security Equipment Room
6	1.2.06 Battery Room
7	1.2.07 Machine Room
8	1.2.08 Water Tanks

Number of zones **8**

Thermostats and Zone Data:

Zone	Cooling T-Stat Occ. (C)	Cooling T-Stat Unocc. (C)	Heating T-Stat Occ. (C)	Heating T-Stat Unocc. (C)	T-Stat Throttling Range (C)	Diversity Factor (%)	Direct Exhaust Fan (kW)
All	25,6	25,6	5,0	5,0	0,83	n/a	0,0

Thermostat Schedule ..... **Fan/Thermostat**
Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:

Cooling Coil:

Design Supply Temp. ..... **14,0** C
Cooling Source ..... **Chilled Water**
Schedule ..... **JFMAMJJASOND**

Heating Coil:

Not Used

Fan Control ..... **3-Speed Fan**
Low-Speed Airflow ..... **50** %
Mid-Speed Airflow ..... **67** %

Terminal Units Data:

Zone	Terminal Type	Air Distribution	Air Distribution Effectiveness Specification	Air Distribution Effectiveness	Minimum Airflow	Design Supply Temp.	Fan Perf.	Fan Efficiency
All	Fan coil	Ceiling supply / ceiling return	Not Used	-	0,00 L/s/person	-	62 Pa	50 %

4. Sizing Data (Computer-Generated):

System Sizing Data:

Sizing Data:

Cooling Supply Temperature ..... **n/a** C

Hydronic Sizing Specifications:

Chilled Water Supply Temperature ..... **6,0** C
Chilled Water Delta-T ..... **6,0** K
Hot Water Supply Temperature ..... **45,0** C
Hot Water Delta-T ..... **5,0** K

Safety Factors:

Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **10** %

Zone Sizing Data:

Zone Airflow Sizing Method ..... **Sum of space airflow rates**
Space Airflow Sizing Method ..... **Individual peak space loads**

5. Equipment Data

Changeover Controller:

Used ..... **No**

Civil - Control Building Input Data

Project: Calculations
Prepared by: IPS

10-05-2025
11:55

1. General Details:

Name ..... **Civil - Control Building**
Energy Sim. Status ..... **Calculated**
Baseline-90° Status ..... **Not Calculated**
Baseline-180° Status ..... **Not Calculated**
Baseline-270° Status ..... **Not Calculated**

2. Plants Included in this Alternative:

(none)

3. Air Systems Included in this Alternative:

Air System	# Zones
Civil - Control Building - AHU 0.1 (Offices 0)	21
Civil - Control Building - AHU 0.2 (Telecom)	2
Civil - Control Building - AHU 0.3 (Battery)	1
Civil - Control Building - AHU 1.1 (Offices 1)	18
Civil - Control Building - AHU 1.2 (Tech)	7

4. Space Models Included in this Alternative:

Summary Calculation Status:

Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Space Model: Civil - Control Building (for Control Building)

Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Zone	Air System
0.1.01 Corridor (0)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.02 Lobby (North)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.03 Lobby (West)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.04 Corridor (SW)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.05 Corridor (SE)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.06 Washroom (Senior Office)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.07 Toilets M	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.08 Toilets F	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.09 Dinning Room	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.10 Kitchen / Tea Prep (0)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.11 Pantry (0)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.12 Prayer Room F	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.13 Muster Room	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.14 Senior Office	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.15 Office 1	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.16 Meeting Room (0)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.17 Storage (East)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.18 Storage (West)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.19 Storage (Stairs)	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.20 Senior Store	Civil - Control Building - AHU 0.1 (Offices 0)
0.1.21 HVAC Room (0)	Civil - Control Building - AHU 0.1 (Offices 0)

0.2.01 Telecom Room	Civil - Control Building - AHU 0.2 (Telecom)
0.2.02 GSM Room	Civil - Control Building - AHU 0.2 (Telecom)
0.3 Battery Room	Civil - Control Building - AHU 0.3 (Battery)
1.1.01 Corridor (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.02 Lobby (Control Room)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.03 Toilets M	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.04 Prayer Room M	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.05 Meeting Room (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.06 Office 2	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.07 Office 3	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.08 Office 4	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.09 Office 5	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.10 Kitchen / Tea Prep. (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.11 Pantry (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.12 Storage Room (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.13 Control Room Filing	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.14 Control Room Training	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.15 Control Room	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.16 Engineering Room	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.17 HVAC Room (1)	Civil - Control Building - AHU 1.1 (Offices 1)
1.1.18 Corridor (2)	Civil - Control Building - AHU 1.1 (Offices 1)
1.2.01 Marshaling Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.02 Auxiliary Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.03 Server Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.04 UPS Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.05 Security Equipment Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.07 Machine Room	Civil - Control Building - AHU 1.2 (Tech)
1.2.08 Water Tanks	Civil - Control Building - AHU 1.2 (Tech)

5. Miscellaneous Energy

Name	Process Load	Energy/Fuel Type	Peak Use	Schedule
EF 0.1.1 - Washroom	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.1.2 - Toilets Level 0	No	Electric	0,2 kW	Schedule - Exhaust Fans
EF 0.1.3 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 1.1.1 - Toilets Level 1	No	Electric	0,3 kW	Schedule - Exhaust Fans
EF 1.1.2 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.3 A/B - Battery Room	No	Electric	1,9 kW	Schedule - Exhaust Fans
FAF 0 A/B - Fresh Air Level 0	No	Electric	2,5 kW	Schedule - Exhaust Fans
FAF 1 A/B - Fresh Air Level 1	No	Electric	1,8 kW	Schedule - Exhaust Fans
EF 0 A/B - Exhaust Level 0	No	Electric	0,5 kW	Schedule - Exhaust Fans
EF 1 A/B - Exhaust Level 1	No	Electric	0,5 kW	Schedule - Exhaust Fans

6. Meters

Electric ..... **Tarifa não residencial**

7. Miscellaneous Data

Average Building Power Factor ..... **100,00** %
Source Electric Generating Efficiency ..... **40,00** %
Additional Floor Area ..... **0,0** sqm

HVAC - Control Building Input Data

Project: Calculations
Prepared by: IPS

10-05-2025
11:55

1. General Details:

Name ..... **HVAC - Control Building**
Energy Sim. Status ..... **Calculated**
Baseline-90° Status ..... **Not Calculated**
Baseline-180° Status ..... **Not Calculated**
Baseline-270° Status ..... **Not Calculated**

2. Plants Included in this Alternative:

(none)

3. Air Systems Included in this Alternative:

Air System	# Zones
HVAC - Control Building - AHU 0.1 (Offices 0)	21
HVAC - Control Building - AHU 0.2 (Telecom)	2
HVAC - Control Building - AHU 0.3 (Battery)	1
HVAC - Control Building - AHU 1.1 (Offices 1)	18
HVAC - Control Building - AHU 1.2 (Tech)	7

4. Space Models Included in this Alternative:

Summary Calculation Status:
Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Space Model: HVAC - Control Building (for Control Building)
Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Zone	Air System
0.1.01 Corridor (0)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.02 Lobby (North)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.03 Lobby (West)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.04 Corridor (SW)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.05 Corridor (SE)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.06 Washroom (Senior Office)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.07 Toilets M	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.08 Toilets F	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.09 Dinning Room	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.10 Kitchen / Tea Prep (0)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.11 Pantry (0)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.12 Prayer Room F	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.13 Muster Room	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.14 Senior Office	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.15 Office 1	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.16 Meeting Room (0)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.17 Storage (East)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.18 Storage (West)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.19 Storage (Stairs)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.1.20 Senior Store	HVAC - Control Building - AHU 0.1 (Offices 0)

0.1.21 HVAC Room (0)	HVAC - Control Building - AHU 0.1 (Offices 0)
0.2.01 Telecom Room	HVAC - Control Building - AHU 0.2 (Telecom)
0.2.02 GSM Room	HVAC - Control Building - AHU 0.2 (Telecom)
0.3 Battery Room	HVAC - Control Building - AHU 0.3 (Battery)
1.1.01 Corridor (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.02 Lobby (Control Room)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.03 Toilets M	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.04 Prayer Room M	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.05 Meeting Room (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.06 Office 2	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.07 Office 3	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.08 Office 4	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.09 Office 5	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.10 Kitchen / Tea Prep. (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.11 Pantry (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.12 Storage Room (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.13 Control Room Filing	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.14 Control Room Training	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.15 Control Room	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.16 Engineering Room	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.17 HVAC Room (1)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.1.18 Corridor (2)	HVAC - Control Building - AHU 1.1 (Offices 1)
1.2.01 Marshaling Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.02 Auxiliary Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.03 Server Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.04 UPS Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.05 Security Equipment Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.07 Machine Room	HVAC - Control Building - AHU 1.2 (Tech)
1.2.08 Water Tanks	HVAC - Control Building - AHU 1.2 (Tech)

5. Miscellaneous Energy

Name	Process Load	Energy/Fuel Type	Peak Use	Schedule
EF 0.1.1 - Washroom	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.1.2 - Toilets Level 0	No	Electric	0,2 kW	Schedule - Exhaust Fans
EF 0.1.3 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 1.1.1 - Toilets Level 1	No	Electric	0,3 kW	Schedule - Exhaust Fans
EF 1.1.2 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.3 A/B - Battery Room	No	Electric	1,9 kW	Schedule - Exhaust Fans
FAF 0 A/B - Fresh Air Level 0	No	Electric	2,5 kW	Schedule - Exhaust Fans
FAF 1 A/B - Fresh Air Level 1	No	Electric	1,8 kW	Schedule - Exhaust Fans
EF 0 A/B - Exhaust Level 0	No	Electric	0,5 kW	Schedule - Exhaust Fans
EF 1 A/B - Exhaust Level 1	No	Electric	0,5 kW	Schedule - Exhaust Fans

6. Meters

Electric ..... **Tarifa não residencial**

7. Miscellaneous Data

Average Building Power Factor ..... **100,00** %
Source Electric Generating Efficiency ..... **40,00** %
Additional Floor Area ..... **0,0** sqm

IPS - Control Building Input Data

Project: Calculations
Prepared by: IPS

10-05-2025
11:56

1. General Details:

Name ..... **IPS - Control Building**
Energy Sim. Status ..... **Calculated**
Baseline-90° Status ..... **Not Calculated**
Baseline-180° Status ..... **Not Calculated**
Baseline-270° Status ..... **Not Calculated**

2. Plants Included in this Alternative:

Plant Name	Design Sizing	Energy Simulation
IPS - Chiller	Calculated	Calculated
IPS - Heat Pump	Calculated	Calculated
Summary	Calculated	Calculated

3. Air Systems Included in this Alternative:

Air System	# Zones
IPS - Control Building - FAHU 0.1 (Offices 0)	23
IPS - Control Building - FAHU 1.1 (Offices 1)	18
IPS - Control Building - FAHU 1.2 (Tech)	8

4. Space Models Included in this Alternative:

Summary Calculation Status:
Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Space Model: IPS - Control Building (for IPS - Control Building)
Design Sizing ..... **Calculated**
Energy Simulation ..... **Calculated**

Zone	Air System
0.1.01 Corridor (0)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.02 Lobby (North)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.03 Lobby (West)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.04 Corridor (SW)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.05 Corridor (SE)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.06 Washroom (Senior Office)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.07 Toilets M	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.08 Toilets F	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.09 Dinning Room	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.10 Kitchen / Tea Prep (0)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.11 Pantry (0)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.12 Prayer Room F	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.13 Muster Room	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.14 Senior Office	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.15 Office 1	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.16 Meeting Room (0)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.17 Storage (East)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.18 Storage (West)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.19 Storage (Stairs)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.20 Senior Store	IPS - Control Building - FAHU 0.1 (Offices 0)

0.1.21 Telecom Room	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.22 HVAC Room (0)	IPS - Control Building - FAHU 0.1 (Offices 0)
0.1.23 GSM Room	IPS - Control Building - FAHU 0.1 (Offices 0)
1.1.01 Corridor (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.02 Lobby (Control Room)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.03 Toilets M	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.04 Prayer Room M	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.05 Meeting Room (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.06 Office 2	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.07 Office 3	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.08 Office 4	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.09 Office 5	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.10 Kitchen / Tea Prep. (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.11 Pantry (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.12 Storage Room (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.13 Control Room Filing	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.14 Control Room Training	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.15 Control Room	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.16 Engineering Room	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.17 HVAC Room (1)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.1.18 Corridor (2)	IPS - Control Building - FAHU 1.1 (Offices 1)
1.2.01 Marshaling Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.02 Auxiliary Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.03 Server Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.04 UPS Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.05 Security Equipment Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.06 Battery Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.07 Machine Room	IPS - Control Building - FAHU 1.2 (Tech)
1.2.08 Water Tanks	IPS - Control Building - FAHU 1.2 (Tech)

5. Miscellaneous Energy

Name	Process Load	Energy/Fuel Type	Peak Use	Schedule
EF 0.1.1 - Washroom	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.1.2 - Toilets Level 0	No	Electric	0,2 kW	Schedule - Exhaust Fans
EF 0.1.3 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 1.1.1 - Toilets Level 1	No	Electric	0,3 kW	Schedule - Exhaust Fans
EF 1.1.2 - Kitchen Level 0	No	Electric	0,1 kW	Schedule - Exhaust Fans
EF 0.3 A/B - Battery Room	No	Electric	1,9 kW	Schedule - Exhaust Fans

6. Meters

Electric ..... **Tarifa não residencial**

7. Miscellaneous Data

Average Building Power Factor ..... **100,00** %
Source Electric Generating Efficiency ..... **40,00** %
Additional Floor Area ..... **0,0** sqm

Schedule Input Data

Project: Calculations 10-05-2025
Prepared by: IPS 11:59

Fan/Thermostat (Fan / Thermostat)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

O = Occupied; U = Unoccupied

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - CR Equipment (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - CR Light (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - CR People (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - Exhaust Fans (Fractional)

Hourly Profiles:

Profile One

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	1	1	1	1	1	1	1	1	1	1	1	1
Tuesday	1	1	1	1	1	1	1	1	1	1	1	1
Wednesday	1	1	1	1	1	1	1	1	1	1	1	1
Thursday	1	1	1	1	1	1	1	1	1	1	1	1
Friday	1	1	1	1	1	1	1	1	1	1	1	1
Saturday	1	1	1	1	1	1	1	1	1	1	1	1
Sunday	1	1	1	1	1	1	1	1	1	1	1	1
Holiday	1	1	1	1	1	1	1	1	1	1	1	1

Schedule - Office Light (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	30	30	30	30	30	30	30	100	100	100	100	100	100	100	100	100	100	100	100	100	30	30	30	30

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	30	30	30	30	30	30	30	50	71	100	100	100	100	100	100	100	100	100	71	51	30	30	30	30

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - Office People (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	30	30	30	30	30	30	30	100	100	100	100	100	100	100	100	100	100	100	100	100	30	30	30	30

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	30	30	30	30	30	30	30	50	71	100	100	100	100	100	100	100	100	100	71	51	30	30	30	30

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - Ofiice Equipment (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	20	20	20	20	20	20	20	20	20	50	50	50	50	50	50	50	50	50	50	50	20	20	20	20

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	10	10	10	10	10	10	10	10	20	20	20	20	20	20	20	20	20	20	20	20	10	10	10	10

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - Tech Equipment (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Schedule - Tech Light (Fractional)

Hourly Profiles:

1:Design

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

2:Energy

Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

Assignments:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Design	1	1	1	1	1	1	1	1	1	1	1	1
Monday	2	2	2	2	2	2	2	2	2	2	2	2
Tuesday	2	2	2	2	2	2	2	2	2	2	2	2
Wednesday	2	2	2	2	2	2	2	2	2	2	2	2
Thursday	2	2	2	2	2	2	2	2	2	2	2	2
Friday	2	2	2	2	2	2	2	2	2	2	2	2
Saturday	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	2	2	2	2	2	2	2	2	2	2	2	2
Holiday	2	2	2	2	2	2	2	2	2	2	2	2

Wall Constructions

Project: Calculations
Prepared by: IPS

10-05-2025
11:59

Civil - Wall Exterior - Above grade (average)

Wall Type ..... **Exterior, Above Grade Wall**
Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Medium**
Outside Absorptivity **0,675**
Overall U-Value ..... **1,462** W/(sqm K)

Wall Assembly Layers - (Inside Space to Outside)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,13000	
Projected plaster	20,0	800,9	1,09	0,01000	16,0
Concreat Block	100,0	464,5	0,88	0,16000	46,5
Air Space	-	-	-	0,18100	0,0
Concreat Block	100,0	464,5	0,88	0,16000	46,5
Mortar	20,0	1922,2	0,84	0,00300	38,4
Outside Surface Resistance				0,04000	
Totals	**240,0**	**-**	**-**	**0,68400**	**147,4**

Civil - Wall Exterior - Below grade

Wall Type ..... **Exterior, Below Grade Wall**
Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Overall U-Value ..... **1,435** W/(sqm K)

Wall Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,13000	
Projected plaster	20,0	800,9	1,09	0,06700	16,0
Concrete block	100,0	464,5	0,88	0,15000	46,5
Air Space	-	-	-	0,17000	0,0
Concrete block	100,0	464,5	0,88	0,15000	46,5
Totals	**220,0**	**-**	**-**	**0,69694**	**108,9**

HVAC - Wall Exterior - Above grade

Wall Type ..... **Exterior, Above Grade Wall**
Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Medium**
Outside Absorptivity **0,675**
Overall U-Value ..... **0,376** W/(sqm K)

Wall Assembly Layers - (Inside Space to Outside)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,13000	
Projected plaster	20,0	800,9	1,09	0,06700	16,0
Concreat Block	200,0	464,5	0,88	0,30000	92,9
Wallmate(XPS)	78,0	40,0	1,47	2,10795	3,1
Mortar	20,0	1922,2	0,84	0,01500	38,4
Outside Surface Resistance				0,04000	
Totals	**318,0**	**-**	**-**	**2,65995**	**150,5**

HVAC - Wall Exterior - Below grade

Wall Type ..... **Exterior, Below Grade Wall**
Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Overall U-Value ..... **0,376** W/(sqm K)

Wall Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,13000	
Projected plaster	20,0	800,9	1,09	0,06700	16,0
Concrete block	200,0	464,5	0,88	0,30000	92,9
Wallmate (XPS)	79,0	40,0	1,47	2,13498	3,2
Totals	**299,0**	**-**	**-**	**2,66191**	**112,1**

Wall Interior

Wall Type ..... **Interior Wall**
Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Light**
Outside Absorptivity **0,450**
Overall U-Value ..... **1,442** W/(sqm K)

Wall Assembly Layers - (Inside Space to Outside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,13000	
Projected plaster	20,0	800,9	1,09	0,06700	16,0
Concrete block	200,0	1281,5	0,84	0,30000	256,3
Projected plaster	20,0	800,9	1,09	0,06650	16,0
Outside Surface Resistance				0,13000	
Totals	**240,0**	**-**	**-**	**0,69350**	**288,3**

Roof Constructions

Project: Calculations
Prepared by: IPS

10-05-2025
12:00

Civil - Roof

Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Light**
Outside Absorptivity **0,450**
Overall U-Value ..... **0,571** W/(sqm K)

Roof Assembly Layers - (Outside to Inside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Outside Surface Resistance				0,04000	
Mortar	100,0	1281,5	0,84	0,07700	128,1
Roofmate (XPS)	50,0	40,0	1,47	1,35100	2,0
Waterproofing	5,0	1121,3	1,51	0,02200	5,6
Concrete	200,0	1281,5	0,84	0,09500	256,3
Projected plaster	20,0	1121,3	1,51	0,06700	22,4
Inside Surface Resistance				0,10000	
Totals	**375,0**	**-**	**-**	**1,75200**	**414,5**

HVAC - Roof

Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Light**
Outside Absorptivity **0,450**
Overall U-Value ..... **0,390** W/(sqm K)

Roof Assembly Layers - (Outside to Inside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Outside Surface Resistance				0,04000	
Mortar	100,0	1281,5	0,84	0,07700	128,1
Roofmate (XPS)	80,0	40,0	1,47	2,16200	3,2
Waterproofing	5,0	1121,3	1,51	0,02200	5,6
Concrete	200,0	1281,5	0,84	0,09500	256,3
Projected plaster	20,0	1121,3	1,51	0,06700	22,4
Inside Surface Resistance				0,10000	
Totals	**405,0**	**-**	**-**	**2,56300**	**415,7**

Ceiling Constructions

Project: Calculations 10-05-2025
Prepared by: IPS 12:01

Acoustic Tile Ceiling

Inside Surface Color ..... **Light**
Inside Absorptivity **0,450**
Outside Surface Color ..... **Light**
Outside Absorptivity **0,450**
Overall U-Value ..... **1,887** W/(sqm K)

Ceiling Assembly Layers - (Outside Space to Inside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Outside Surface Resistance				0,10000	
Acoustic Tile	20,0	368,4	0,59	0,33000	7,4
Inside Surface Resistance				0,10000	
Totals	**20,0**	**-**	**-**	**0,53000**	**7,4**

Floor Constructions

Project: Calculations
Prepared by: IPS

10-05-2025
12:01

Civil - Floor exterior - Below grade

Floor Type ..... **Slab Floor Below Grade**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Overall U-Value ..... **0,592** W/(sqm K)

Floor Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,17000	
Ceramic tile	10,0	2563,0	0,80	0,00800	25,6
Mortar	50,0	2242,6	0,92	0,03800	112,1
Concrete	200,0	2242,6	0,92	0,12100	448,5
Floormate	50,0	40,0	1,47	1,35100	2,0
Totals	**310,0**	**-**	**-**	**1,68800**	**588,3**

Civil - Floor exterior - On grade

Floor Type ..... **Slab Floor On Grade**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Overall U-Value ..... **0,592** W/(sqm K)

Floor Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,17000	
Ceramic tile	10,0	2563,0	0,80	0,00800	25,6
Mortar	50,0	2242,6	0,92	0,03800	112,1
Concrete	200,0	2242,6	0,92	0,12100	448,5
Floormate	50,0	40,0	1,47	1,35100	2,0
Totals	**310,0**	**-**	**-**	**1,68800**	**588,3**

False Floor

Floor Type ..... **Floor Above Space**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Outside Surface Color ..... **Medium**
Outside Absorptivity **0,675**
Overall U-Value ..... **3,030** W/(sqm K)

Floor Assembly Layers - (Inside Space to Outside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,10000	
Wood	20,0	608,7	1,63	0,13000	12,2
Outside Surface Resistance				0,10000	
Totals	**20,0**	**-**	**-**	**0,33000**	**12,2**

Floor Constructions

Project: Calculations 10-05-2025
Prepared by: IPS 12:01

Floor interior

Floor Type ..... **Floor Above Space**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Outside Surface Color ..... **Medium**
Outside Absorptivity **0,675**
Overall U-Value ..... **1,742** W/(sqm K)

Floor Assembly Layers - (Inside Space to Outside Space)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,17000	
Ceramic tile	12,7	288,3	1,38	0,00800	3,7
Mortar	304,8	2242,6	0,92	0,03800	683,5
Concrete	304,8	2242,6	0,92	0,12100	683,5
Projected plaster	0,9	7833,0	0,50	0,06700	6,8
Outside Surface Resistance				0,17000	
Totals	**623,2**	**-**	**-**	**0,57400**	**1377,5**

HVAC - Floor exterior - Below grade

Floor Type ..... **Slab Floor Below Grade**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Overall U-Value ..... **0,510** W/(sqm K)

Floor Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,17000	
Ceramic tile	10,0	2563,0	0,80	0,00800	25,6
Mortar	50,0	2242,6	0,92	0,03800	112,1
Concrete	200,0	2242,6	0,92	0,12100	448,5
Floormate	60,0	40,0	1,47	1,62200	2,4
Totals	**320,0**	**-**	**-**	**1,95900**	**588,7**

HVAC - Floor exterior - On grade

Floor Type ..... **Slab Floor On Grade**
Inside Surface Color ..... **Medium**
Inside Absorptivity **0,675**
Overall U-Value ..... **0,510** W/(sqm K)

Floor Assembly Layers - (Inside Space to Soil)

Layers	Thickness mm	Density kg/m3	Specific Heat kJ / (kg K)	R-Value (sqm K)/W	Weight kg/sqm
Inside Surface Resistance				0,17000	
Ceramic tile	10,0	2563,0	0,80	0,00800	25,6
Mortar	50,0	2242,6	0,92	0,03800	112,1
Concrete	200,0	2242,6	0,92	0,12100	448,5
Floormate	60,0	40,0	1,47	1,62200	2,4
Totals	**320,0**	**-**	**-**	**1,95900**	**588,7**

Window Constructions

Project: Calculations
Prepared by: IPS

10-05-2025
12:02

Door FF

Input Method ..... **Simple input method**

Window Performance:

Overall U-Value ..... **2,000** W/(sqm K)
Overall SHGC **0,100**
Overall VT **0,100**

Internal Shade:

Type ..... **Drapes - Closed Weave - Light**

Window

Input Method ..... **Simple input method**

Window Performance:

Overall U-Value ..... **3,610** W/(sqm K)
Overall SHGC **0,400**
Overall VT **0,730**

Internal Shade:

Type ..... **None**

Door Constructions

Project: Calculations 10-05-2025
Prepared by: IPS 12:02

Door

Door Type ..... **Opaque Door**
Opaque U-Value ..... **2,000** W/(sqm K)

Chiller Input Data

Project: Calculations
Prepared by: IPS

10-05-2025
12:03

Chiller

General Details

Name ..... **Chiller**
Equipment Function ..... **Chiller (Chilled Water Only)**
Equipment Type ..... **A/C Packaged Screw**
Data Source ..... **User Input**

Notes:

Cooling Design Inputs

Full Load LCHWT ..... **6,0** C
Full Load OAT ..... **51,0** C
Full Load Capacity ..... **Auto-Sized**
Full Load Input Power ..... **0,341** ikW/kW
Average Operating Loss ..... **9,0** %
Chilled Water Supply Flow Rate ..... **0,043** L/(s kW)

Controls and Features

Minimum Load ..... **20,0** %
DX Free Cooling ..... **Not Used**
Heat Recovery Method ..... **Not Used**
Hot Gas Bypass ..... **No**

Cooling Performance

Input Power [ikW/kW]:

OAT (C)	Max Cap	100%	90%	80%	70%	60%	50%	40%	30%	20%
51,7	0,544	0,544	0,551	0,560	0,576	0,596	0,620	0,647	0,794	0,842
35,0	0,341	0,341	0,343	0,345	0,352	0,374	0,385	0,397	0,461	0,480
29,4	0,302	0,302	0,302	0,303	0,307	0,330	0,338	0,347	0,390	0,406
23,9	0,270	0,270	0,269	0,268	0,268	0,297	0,300	0,306	0,336	0,349
-17,8	0,247	0,247	0,243	0,239	0,235	0,258	0,254	0,248	0,258	0,233

Input Power LCHWT Factor a **0,01874** 1/K
Input Power LCHWT Factor b **0,00000** 1/K2

Heat Pump

General Details

Name ..... **Heat Pump**
Equipment Function ..... **Heat Pump (Hot Water Only)**
Equipment Type ..... **Air-Source Packaged Scroll**
Data Source ..... **User Input**

Notes:

Heating Design Inputs

Full Load HWST ..... **45,0** C
Full Load OAT ..... **5,0** C
Full Load Capacity ..... **Auto-Sized**
Full Load Input Power ..... **0,361** ikW/kW
Average Operating Loss ..... **5,0** %
Hot Water Supply Flow Rate ..... **5,0** K

Controls and Features

Minimum Load ..... **20,0** %
Hot Gas Bypass ..... **No**

Heating Performance

Input Power [ikW/kW]:

OAT (C)	Max Cap	100%	90%	80%	70%	60%	50%	40%	30%	20%
40,0	0,030	0,030	0,029	0,029	0,029	0,030	0,030	0,032	0,034	0,038
30,0	0,031	0,031	0,031	0,030	0,030	0,030	0,031	0,033	0,035	0,039
15,0	0,035	0,035	0,035	0,035	0,035	0,035	0,036	0,037	0,040	0,044
5,0	0,040	0,040	0,040	0,041	0,041	0,042	0,043	0,045	0,047	0,052
0,0	0,053	0,053	0,053	0,054	0,055	0,056	0,058	0,060	0,063	0,070
-5,0	0,059	0,059	0,059	0,060	0,061	0,062	0,064	0,067	0,070	0,078
-10,0	0,065	0,065	0,065	0,066	0,068	0,069	0,072	0,074	0,078	0,086
-15,0	0,072	0,072	0,072	0,073	0,075	0,077	0,079	0,082	0,087	0,096

OAT (C)	10%
40,0	0,049
30,0	0,051
15,0	0,057
5,0	0,067
0,0	0,089
-5,0	0,100
-10,0	0,111
-15,0	0,124

Performance HWST Factor a ..... **-0,01280** 1/K
Performance HWST Factor b ..... **-0,00003** 1/K2

Electric Rate Input Data

Project: Calculations 10-05-2025
Prepared by: IPS 12:04

Tarifa não residencial

General Details

Rate Name	**Tarifa não residencial**	
Rate Type	**Simple**	
Energy Units	**kWh**	
Conversion	**1,00000**	kWh/kWh
Demand Units	**kW**	
Flat Price	**0,07200**	€/kWh
Customer Charge	**0,00**	€
Minimum Charge	**0,00**	€
Tax Rate	**0,00**	%

Emissions Analysis

CO2e Factor	**0,36**	kg/kWh

Anexo VIII

HAP Calculations - Reports

Relatórios com os resultados dos cálculos e simulações do programa HAP 6.2. Por motivos de confidencialidade, estes relatórios foram editados para este estudo tendo sido omitidas todas as referências ao local do projecto e ao cliente.

1 Design Load Reports - Original
2 Simulation Reports - Original
3 Design Load Reports – Alternativa Envolvente
4 Simulation Reports – Alternativa Envolvente
5 Design Load Reports – Alternativa Chiller e Bomba de Calor
6 Simulation Reports - Alternativa Chiller e Bomba de Calor
7 Simulation Reports - Alternativa Chiller com recuperaçãor

Air System Sizing Summary for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name	**Civil - Control Building - AHU 0.1 (Offices 0)**	Number of zones	**21**	
Equipment Class	**SPLT AHU**	Floor Area	**797,4**	sqm
Air System Type	**VAV**	Location	**Middle East**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**173,0**	kW	Peak coil load occurs at	**agosto 15:00**	
Sensible coil load	**127,5**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**4094**	L/s	Entering DB / WB	**39,7 / 24,8**	C
Sum of peak zone L/s	**4445**	L/s	Leaving DB / WB	**14,2 / 14,1**	C
Sensible heat ratio	**0,737**		Resulting RH	**54**	%
L/(s kW)	**23,7**		Design supply temp.	**16,0**	C
sqm/kW	**4,6**		Zone T-stat Check	**21 of 21**	OK
W/sqm	**216,9**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**19,7**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**2881**	L/s	Ent. DB / Lvg DB	**7,3 / 13,0**	C
Max coil L/s	**4373**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 0:00	**49,41**	kg/hr	Air mass flow	**9707,72**	kg/hr
Airflow Rate	**2280**	L/s	Moisture gain	**,00509**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**14,2**	kW	Load occurs at	**agosto 22:00**	
Coil L/s at agosto 22:00	**4061**	L/s	W/sqm	**17,8**	
Max coil L/s	**4373**	L/s	Ent. DB / Lvg DB	**15,4 / 18,3**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**4373**	L/s	Fan motor BHP	**9,19**	BHP
Design L/s occurs at	**julho 17:00**		Fan motor kW	**7,29**	kW
Design L/(s sqm)	**5,48**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**4445**	L/s			
VAV Fan Diversity	**1,6**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**2280**	L/s	L/s/person	**47,50**	L/s/person
L/(s sqm)	**2,86**	L/(s sqm)			

Zone Sizing Summary for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name **Civil - Control Building - AHU 0.1 (Offices 0)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **21**
Floor Area **797,4** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.1.01 Corridor (0)	146	83	0,90	3,3	-	0,0	-	0
0.1.02 Lobby (North)	167	167	17,18	3,8	-	0,0	-	0
0.1.03 Lobby (West)	111	111	22,20	2,5	-	0,0	-	0
0.1.04 Corridor (SW)	121	111	4,47	2,7	-	0,0	-	0
0.1.05 Corridor (SE)	111	111	4,05	2,5	-	0,0	-	0
0.1.06 Washroom (Senior Office)	56	56	8,74	1,3	-	0,0	-	0
0.1.07 Toilets M	181	181	10,04	4,1	-	0,0	-	0
0.1.08 Toilets F	167	167	9,25	3,8	-	0,0	-	0
0.1.09 Dinning Room	248	167	7,53	3,8	-	0,0	-	0
0.1.10 Kitchen / Tea Prep (0)	216	83	11,96	1,9	-	0,0	-	0
0.1.11 Pantry (0)	153	153	8,49	3,5	-	0,0	-	0
0.1.12 Prayer Room F	304	83	11,14	1,9	-	0,0	-	0
0.1.13 Muster Room	459	153	7,15	3,5	-	0,0	-	0
0.1.14 Senior Office	195	42	5,39	1,3	-	0,0	-	0
0.1.15 Office 1	99	28	5,49	0,7	-	0,0	-	0
0.1.16 Meeting Room (0)	386	208	7,58	4,7	-	0,0	-	0
0.1.17 Storage (East)	57	56	4,31	1,3	-	0,0	-	0
0.1.18 Storage (West)	69	69	3,88	1,6	-	0,0	-	0
0.1.19 Storage (Stairs)	46	42	5,01	0,9	-	0,0	-	0
0.1.20 Senior Store	54	42	4,21	0,9	-	0,0	-	0
0.1.21 HVAC Room (0)	1099	167	5,37	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.1.01 Corridor (0)	1,4	julho 19:00	2,4	162,3
0.1.02 Lobby (North)	1,5	julho 17:00	0,8	9,7
0.1.03 Lobby (West)	0,4	agosto 16:00	0,3	5,0
0.1.04 Corridor (SW)	0,8	setembro 15:00	2,0	27,2
0.1.05 Corridor (SE)	0,6	setembro 14:00	1,4	27,4
0.1.06 Washroom (Senior Office)	0,0	julho 19:00	0,1	6,4
0.1.07 Toilets M	0,6	julho 17:00	0,5	18,0
0.1.08 Toilets F	0,7	julho 17:00	0,5	18,1
0.1.09 Dinning Room	2,4	julho 16:00	0,9	32,9
0.1.10 Kitchen / Tea Prep (0)	2,1	julho 17:00	0,5	18,1
0.1.11 Pantry (0)	0,7	julho 18:00	0,4	18,0
0.1.12 Prayer Room F	2,9	julho 18:00	1,2	27,2
0.1.13 Muster Room	4,4	julho 16:00	2,2	64,2
0.1.14 Senior Office	1,9	julho 17:00	0,9	36,1
0.1.15 Office 1	0,9	julho 17:00	0,5	18,1
0.1.16 Meeting Room (0)	3,7	julho 17:00	1,3	50,9
0.1.17 Storage (East)	0,6	julho 18:00	0,4	13,2
0.1.18 Storage (West)	0,6	julho 18:00	0,4	17,8
0.1.19 Storage (Stairs)	0,5	julho 18:00	0,4	9,1
0.1.20 Senior Store	0,6	julho 18:00	0,4	12,9
0.1.21 HVAC Room (0)	12,5	agosto 18:00	0,0	204,8

Zone Sizing Summary for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.1.01 Corridor (0)						
0.1.01 Corridor (0)	1,3	julho 19:00	136	2,1	152,3	0,90
0.1.01 Corridor (0)	0,1	julho 19:00	10	0,3	10,0	1,00
0.1.02 Lobby (North)						
0.1.02 Lobby (North)	1,5	julho 17:00	167	0,8	9,7	17,18
0.1.03 Lobby (West)						
0.1.03 Lobby (West)	0,4	agosto 16:00	111	0,3	5,0	22,20
0.1.04 Corridor (SW)						
0.1.04 Corridor (SW)	0,8	setembro 15:00	121	2,0	27,2	4,47
0.1.05 Corridor (SE)						
0.1.05 Corridor (SE)	0,6	setembro 14:00	111	1,4	27,4	4,05
0.1.06 Washroom (Senior Office)						
0.1.06 Washroom (Senior Office)	0,0	julho 19:00	56	0,1	6,4	8,74
0.1.07 Toilets M						
0.1.07 Toilets M	0,6	julho 17:00	181	0,5	18,0	10,04
0.1.08 Toilets F						
0.1.08 Toilets F	0,7	julho 17:00	167	0,5	18,1	9,25
0.1.09 Dinning Room						
0.1.09 Dinning Room	2,4	julho 16:00	248	0,9	32,9	7,53
0.1.10 Kitchen / Tea Prep (0)						
0.1.10 Kitchen / Tea Prep (0)	2,1	julho 17:00	216	0,5	18,1	11,96
0.1.11 Pantry (0)						
0.1.11 Pantry (0)	0,7	julho 18:00	153	0,4	18,0	8,49
0.1.12 Prayer Room F						
0.1.12 Prayer Room F	2,9	julho 18:00	304	1,2	27,2	11,14
0.1.13 Muster Room						
0.1.13 Muster Room	4,4	julho 16:00	459	2,2	64,2	7,15
0.1.14 Senior Office						
0.1.14 Senior Office	1,9	julho 17:00	195	0,9	36,1	5,39
0.1.15 Office 1						
0.1.15 Office 1	0,9	julho 17:00	99	0,5	18,1	5,49
0.1.16 Meeting Room (0)						
0.1.16 Meeting Room (0)	3,7	julho 17:00	386	1,3	50,9	7,58
0.1.17 Storage (East)						
0.1.17 Storage (East)	0,6	julho 18:00	57	0,4	13,2	4,31
0.1.18 Storage (West)						
0.1.18 Storage (West)	0,6	julho 18:00	69	0,4	17,8	3,88
0.1.19 Storage (Stairs)						
0.1.19 Storage (Stairs)	0,5	julho 18:00	46	0,4	9,1	5,01
0.1.20 Senior Store						
0.1.20 Senior Store	0,6	julho 18:00	54	0,4	12,9	4,21
0.1.21 HVAC Room (0)						
0.1.21 HVAC Room (0)	12,5	agosto 18:00	1099	0,0	204,8	5,37

Air System Heat Balance Summary for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:28

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	37454	3078	-	19766	134
Plenum Load	-	0	0	-	0	0
Return Fan Load	1814 L/s	0	-	601 L/s	0	-
Ventilation Load	2280 L/s	76487	36867	2280 L/s	41240	25809
Supply Fan Load	4094 L/s	6874	-	2881 L/s	-4915	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**120815**	**39944**	**-**	**56091**	**25943**
Central Cooling Coil	-	127485	45492	-	0	0
Preheat Coil	-	0	-	-	19654	-
Dehumidification Reheat Coil	-	-3663	-	-	0	-
Humidification	6,03 kg/hr	-238	-3804	38,19 kg/hr	1551	23956
Terminal Reheat Coils	-	-16	-	-	35326	-
>> Total Conditioning	**-**	**123569**	**41688**	**-**	**56530**	**23956**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	398 sqm	11759	-	398 sqm	3897	-
Roof Convection	205 sqm	3653	-	205 sqm	162	-
Window Convection	18 sqm	882	-	18 sqm	426	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	12 sqm	369	-	12 sqm	126	-
Floor Convection	797 sqm	3725	-	797 sqm	2741	-
Interior Wall Convection	1573 sqm	4355	-	1573 sqm	3975	-
Ceiling Convection	593 sqm	5227	-	593 sqm	4710	-
Overhead Lighting Convection	3987 W	1687	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	1346 W	1010	-	0 W	0	-
People Convection	48	1034	2884	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	3370	288	10%	1604	0
>> Total Zone Loads	**-**	**37071**	**3172**	**-**	**17641**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	2280	400	76487	36867
Vent - Return Mixing	Outlet	39,7	0,01380	4094	459	-	-
Preheat Coil	Outlet	39,7	0,01380	4094	459	0	-
Central Cooling Coil	Outlet	14,2	0,01009	4094	459	127485	45492
Supply Fan	Outlet	15,6	0,01009	4094	459	6874	-
Humidifier	Outlet	16,4	0,01044	4094	459	238	3804
Dehumid. Reheat Coil	Outlet	16,4	0,01009	4094	459	3663	-
Cold Supply Duct	Outlet	16,4	0,01044	4094	459	-	-
Zone Air	-	24,6	0,01059	1814	497	37454	3078
Zone Direct Exhaust	Outlet	23,3	0,01066	2280	515	-	-
Return Air	Outlet	24,7	0,01074	1814	534	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.1.01 Corridor (0)	0	Deadband	875	25,1	83	458	0	0
0.1.02 Lobby (North)	0	Deadband	1419	23,4	167	459	0	0
0.1.03 Lobby (West)	0	Deadband	643	21,2	111	459	0	0
0.1.04 Corridor (SW)	0	Deadband	1038	24,1	111	459	0	0
0.1.05 Corridor (SE)	0	Deadband	1007	23,9	111	459	0	0
0.1.06 Washroom (Senior Office)	0	Deadband	298	21,0	56	459	15	0
0.1.07 Toilets M	0	Deadband	1012	21,0	181	459	1	0
0.1.08 Toilets F	0	Deadband	974	21,2	167	459	0	0
0.1.09 Dinning Room	2172	Cooling	2174	24,0	235	693	0	0
0.1.10 Kitchen / Tea Prep (0)	1857	Cooling	1858	24,0	201	596	0	0
0.1.11 Pantry (0)	0	Deadband	965	21,6	153	459	0	0
0.1.12 Prayer Room F	2408	Cooling	2409	24,0	261	565	0	0
0.1.13 Muster Room	4265	Cooling	4242	24,0	459	579	0	0
0.1.14 Senior Office	1666	Cooling	1667	24,0	181	520	0	0
0.1.15 Office 1	869	Cooling	869	24,0	94	518	0	0
0.1.16 Meeting Room (0)	3403	Cooling	3406	24,0	369	683	0	0
0.1.17 Storage (East)	134	Cooling	570	24,8	56	459	0	0
0.1.18 Storage (West)	0	Deadband	621	23,8	69	459	0	0
0.1.19 Storage (Stairs)	0	Deadband	411	24,5	42	459	0	0
0.1.20 Senior Store	289	Cooling	452	25,3	42	459	0	0
0.1.21 HVAC Room (0)	10556	Cooling	10556	25,6	945	459	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

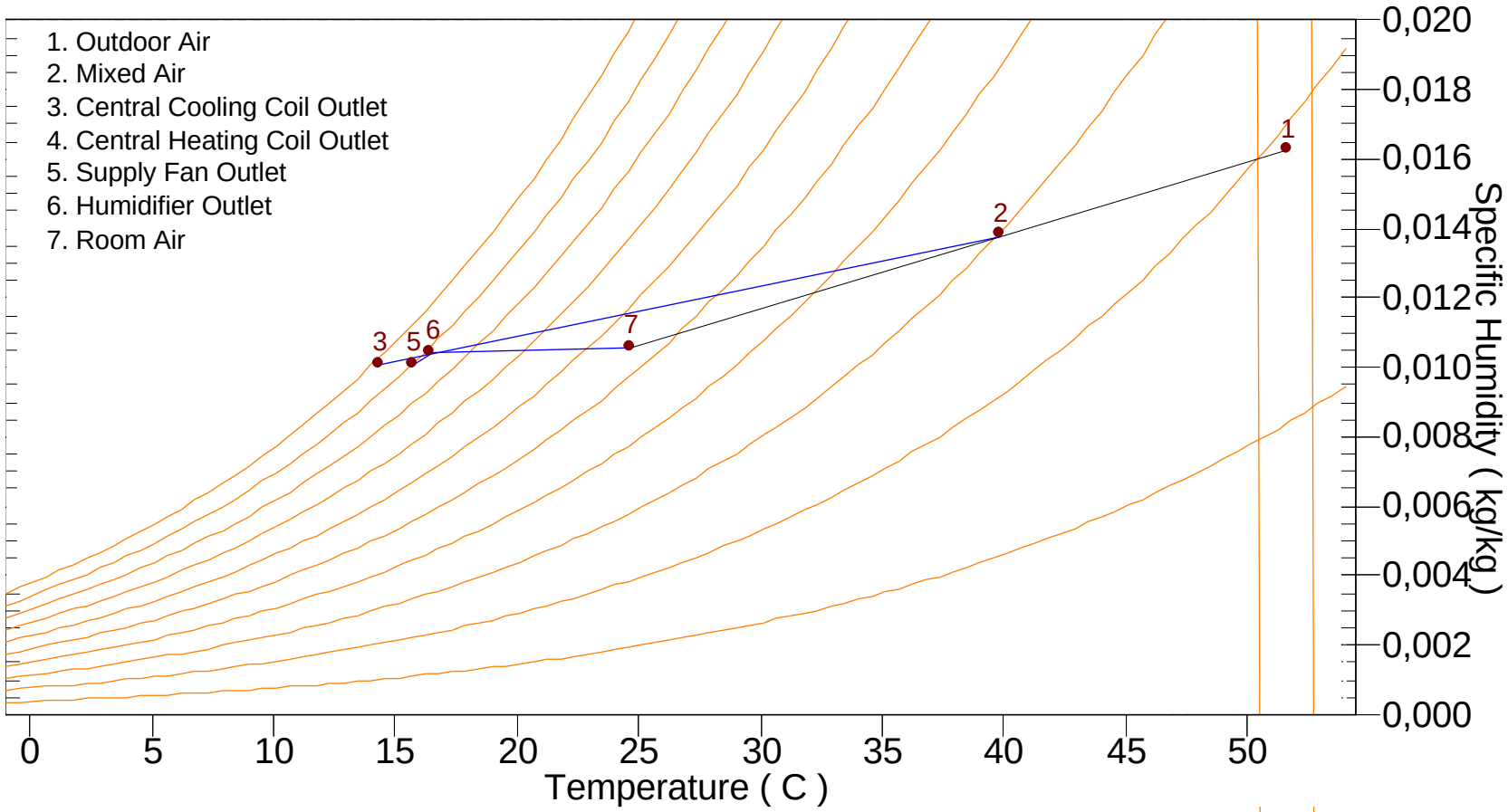
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2280	400	-41240	-25809
Vent - Return Mixing	Outlet	7,3	0,00425	2881	400	-	-
Preheat Coil	Outlet	13,0	0,00425	2881	400	19654	-
Central Cooling Coil	Outlet	13,0	0,00425	2881	400	0	0
Supply Fan	Outlet	14,4	0,00425	2881	400	4915	-
Humidifier	Outlet	14,9	0,00736	2881	400	1551	23956
Dehumid. Reheat Coil	Outlet	14,4	0,00425	2881	400	0	-
Cold Supply Duct	Outlet	14,9	0,00736	2881	400	-	-
Zone Air	-	16,6	0,00734	601	400	-19766	-134
Zone Direct Exhaust	Outlet	19,7	0,00733	2280	400	-	-
Return Air	Outlet	17,9	0,00733	601	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

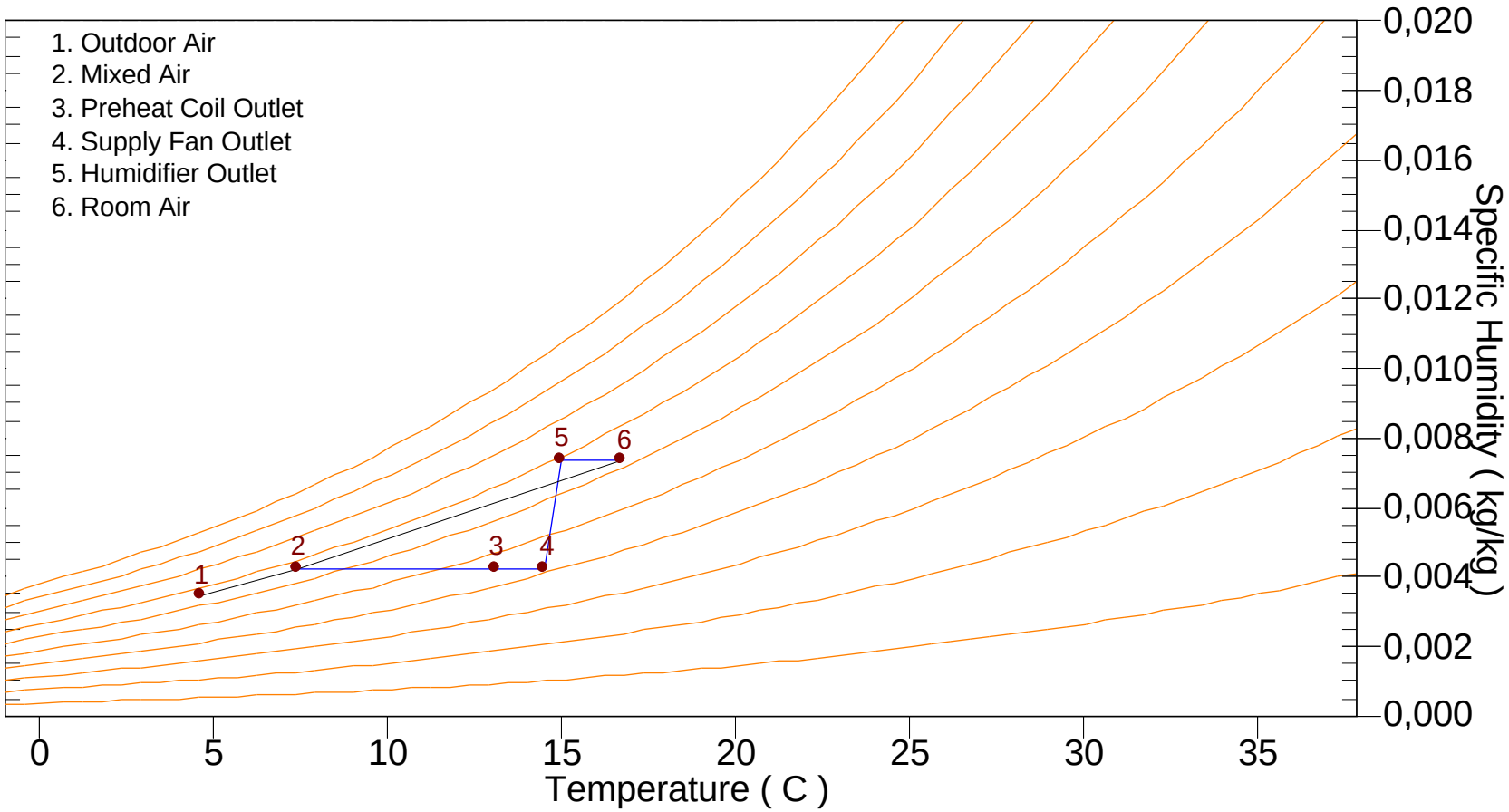
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.1.01 Corridor (0)	-6631	Heating	-2433	19,8	146	400	3295	0
0.1.02 Lobby (North)	-942	Heating	-942	21,0	167	400	2177	0
0.1.03 Lobby (West)	-397	Heating	-397	21,0	111	400	1218	0
0.1.04 Corridor (SW)	-6484	Heating	-2259	18,1	121	400	2739	0
0.1.05 Corridor (SE)	-2556	Heating	-1774	20,3	111	400	2506	0
0.1.06 Washroom (Senior Office)	-156	Heating	-156	21,0	56	400	570	0
0.1.07 Toilets M	-565	Heating	-565	21,0	181	400	1904	0
0.1.08 Toilets F	-580	Heating	-580	21,0	167	400	1815	0
0.1.09 Dinning Room	-1109	Heating	-1109	21,0	167	400	2344	0
0.1.10 Kitchen / Tea Prep (0)	-557	Heating	-557	21,0	83	400	1171	0
0.1.11 Pantry (0)	-551	Heating	-551	21,0	153	400	1683	0
0.1.12 Prayer Room F	-1257	Heating	-1250	21,0	83	400	1863	0
0.1.13 Muster Room	-9484	Heating	-1828	17,8	456	400	3455	0
0.1.14 Senior Office	-5352	Heating	-638	17,5	195	400	1255	0
0.1.15 Office 1	-2837	Heating	-316	17,7	99	400	651	0
0.1.16 Meeting Room (0)	-1615	Heating	-1615	21,0	208	400	3153	0
0.1.17 Storage (East)	-531	Heating	-531	21,0	56	400	945	0
0.1.18 Storage (West)	-532	Heating	-532	21,0	69	400	1042	0
0.1.19 Storage (Stairs)	-395	Heating	-395	21,0	42	400	705	0
0.1.20 Senior Store	-522	Heating	-522	21,0	42	400	833	0
0.1.21 HVAC Room (0)	0	Deadband	-816	10,8	167	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name	**Civil - Control Building - AHU 0.2 (Telecom)**	Number of zones	**2**
Equipment Class	**SPLT AHU**	Floor Area	**195,9** sqm
Air System Type	**VAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**51,8**	kW	Peak coil load occurs at	**agosto 15:00**	
Sensible coil load	**47,2**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**4310**	L/s	Entering DB / WB	**21,4 / 16,0**	C
Sum of peak zone L/s	**4346**	L/s	Leaving DB / WB	**12,3 / 12,2**	C
Sensible heat ratio	**0,913**		Resulting RH	**60**	%
L/(s kW)	**83,3**		Design supply temp.	**16,0**	C
sqm/kW	**3,8**		Zone T-stat Check	**2 of 2**	OK
W/sqm	**264,2**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**2,3**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**181**	L/s	Ent. DB / Lvg DB	**4,4 / 15,0**	C
Max coil L/s	**4310**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 5:00	**2,90**	kg/hr	Air mass flow	**17195,70**	kg/hr
Airflow Rate	**4039**	L/s	Moisture gain	**,00017**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**15,2**	kW	Load occurs at	**maio 9:00**	
Coil L/s at maio 9:00	**4293**	L/s	W/sqm	**77,6**	
Max coil L/s	**4310**	L/s	Ent. DB / Lvg DB	**13,8 / 16,7**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**4310**	L/s	Fan motor BHP	**9,06**	BHP
Design L/s occurs at	**setembro 15:00**		Fan motor kW	**7,18**	kW
Design L/(s sqm)	**22,01**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**4346**	L/s			
VAV Fan Diversity	**0,8**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**181**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**0,92**	L/(s sqm)			

Zone Sizing Summary for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name **Civil - Control Building - AHU 0.2 (Telecom)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **2**
Floor Area **195,9** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.2.01 Telecom Room	3295	167	18,34	3,8	-	0,0	-	0
0.2.02 GSM Room	1051	14	64,91	0,3	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.2.01 Telecom Room	15,7	setembro 15:00	0,6	179,7
0.2.02 GSM Room	5,0	agosto 13:00	0,2	16,2

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.2.01 Telecom Room						
0.2.01 Telecom Room	15,7	setembro 15:00	3295	0,6	179,7	18,34
0.2.02 GSM Room						
0.2.02 GSM Room	5,0	agosto 13:00	1051	0,2	16,2	64,91

Air System Heat Balance Summary for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	20148	172	-	2078	0
Plenum Load	-	0	0	-	0	0
Return Fan Load	4129 L/s	0	-	0 L/s	0	-
Ventilation Load	181 L/s	6788	3810	181 L/s	2474	1163
Supply Fan Load	4310 L/s	7188	-	181 L/s	-1699	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**34124**	**3983**	**-**	**2853**	**1163**
Central Cooling Coil	-	47241	4515	-	-618	-114
Preheat Coil	-	0	-	-	2278	-
Dehumidification Reheat Coil	-	-12878	-	-	0	-
Humidification	0,00 kg/hr	0	0	1,87 kg/hr	71	1176
Terminal Reheat Coils	-	0	-	-	1135	-
>> Total Conditioning	**-**	**34363**	**4515**	**-**	**2866**	**1062**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	59 sqm	3383	-	59 sqm	458	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	4 sqm	228	-	4 sqm	61	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	0 sqm	0	-	0 sqm	0	-
Floor Convection	196 sqm	2757	-	196 sqm	64	-
Interior Wall Convection	169 sqm	2308	-	169 sqm	26	-
Ceiling Convection	196 sqm	4282	-	196 sqm	176	-
Overhead Lighting Convection	979 W	414	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	7000 W	5250	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	1862	0	10%	79	0
>> Total Zone Loads	**-**	**20484**	**0**	**-**	**864**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	181	400	6788	3810
Vent - Return Mixing	Outlet	21,4	0,00929	4310	400	-	-
Preheat Coil	Outlet	21,4	0,00929	4310	400	0	-
Central Cooling Coil	Outlet	12,3	0,00894	4310	400	47241	4515
Supply Fan	Outlet	13,7	0,00894	4310	400	7188	-
Humidifier	Outlet	16,2	0,00894	4310	400	0	0
Dehumid. Reheat Coil	Outlet	16,2	0,00894	4310	400	12878	-
Cold Supply Duct	Outlet	16,2	0,00894	4310	400	-	-
Zone Air	-	20,0	0,00895	4129	400	20148	172
Zone Direct Exhaust	Outlet	20,0	0,00898	181	400	-	-
Return Air	Outlet	20,0	0,00898	4129	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.2.01 Telecom Room	15391	Cooling	15289	20,0	3272	400	0	0
0.2.02 GSM Room	4891	Cooling	4860	20,0	1038	400	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

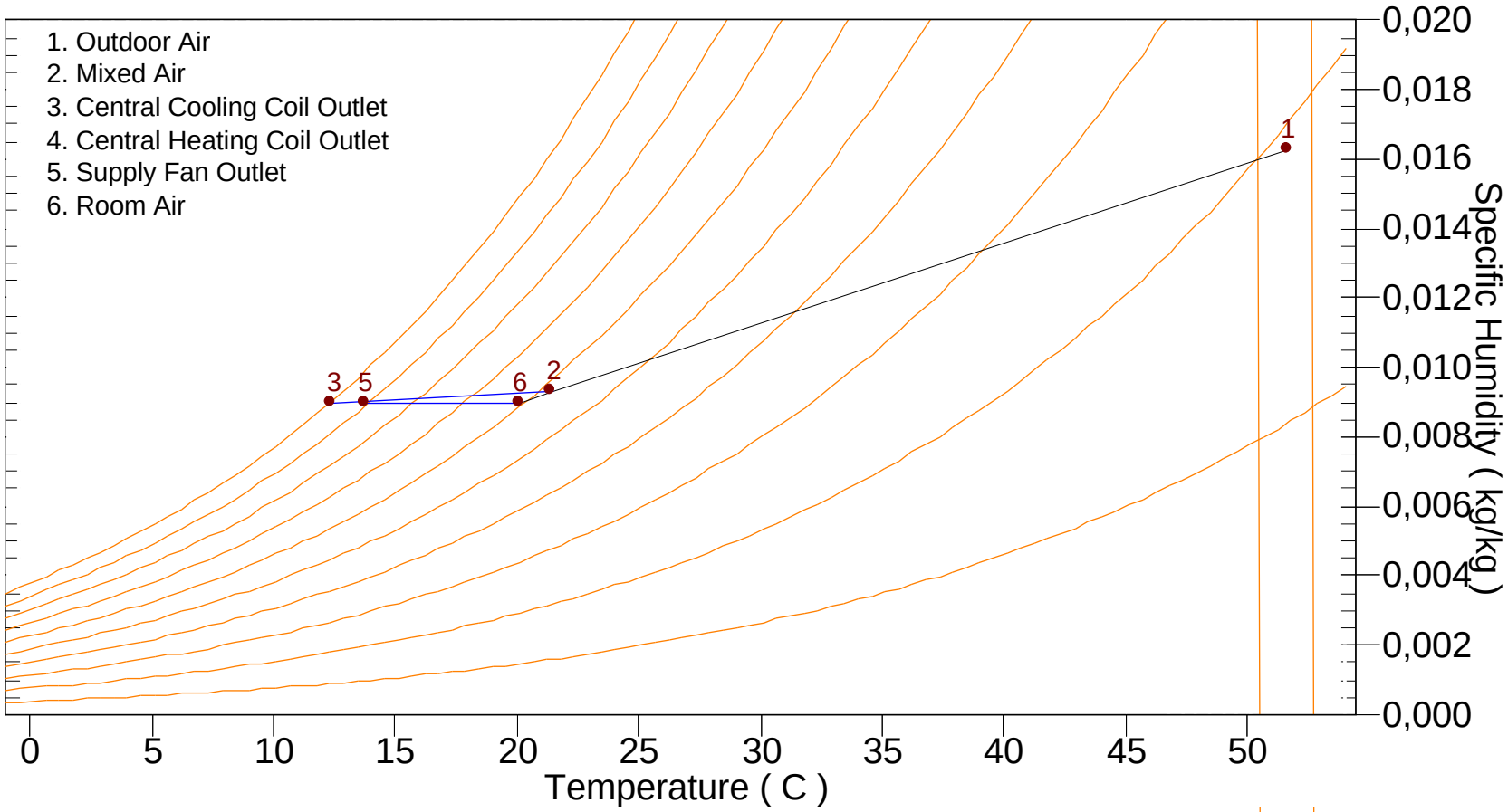
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	181	400	-2474	-1163
Vent - Return Mixing	Outlet	4,5	0,00343	181	400	-	-
Preheat Coil	Outlet	15,0	0,00343	181	400	2278	-
Central Cooling Coil	Outlet	12,2	0,00321	181	400	618	114
Supply Fan	Outlet	20,0	0,00321	181	400	1699	-
Humidifier	Outlet	20,3	0,00565	181	400	71	1176
Dehumid. Reheat Coil	Outlet	20,0	0,00321	181	400	0	-
Cold Supply Duct	Outlet	20,3	0,00565	181	400	-	-
Zone Air	-	16,0	0,00565	0	400	-2078	0
Zone Direct Exhaust	Outlet	16,0	0,00565	181	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

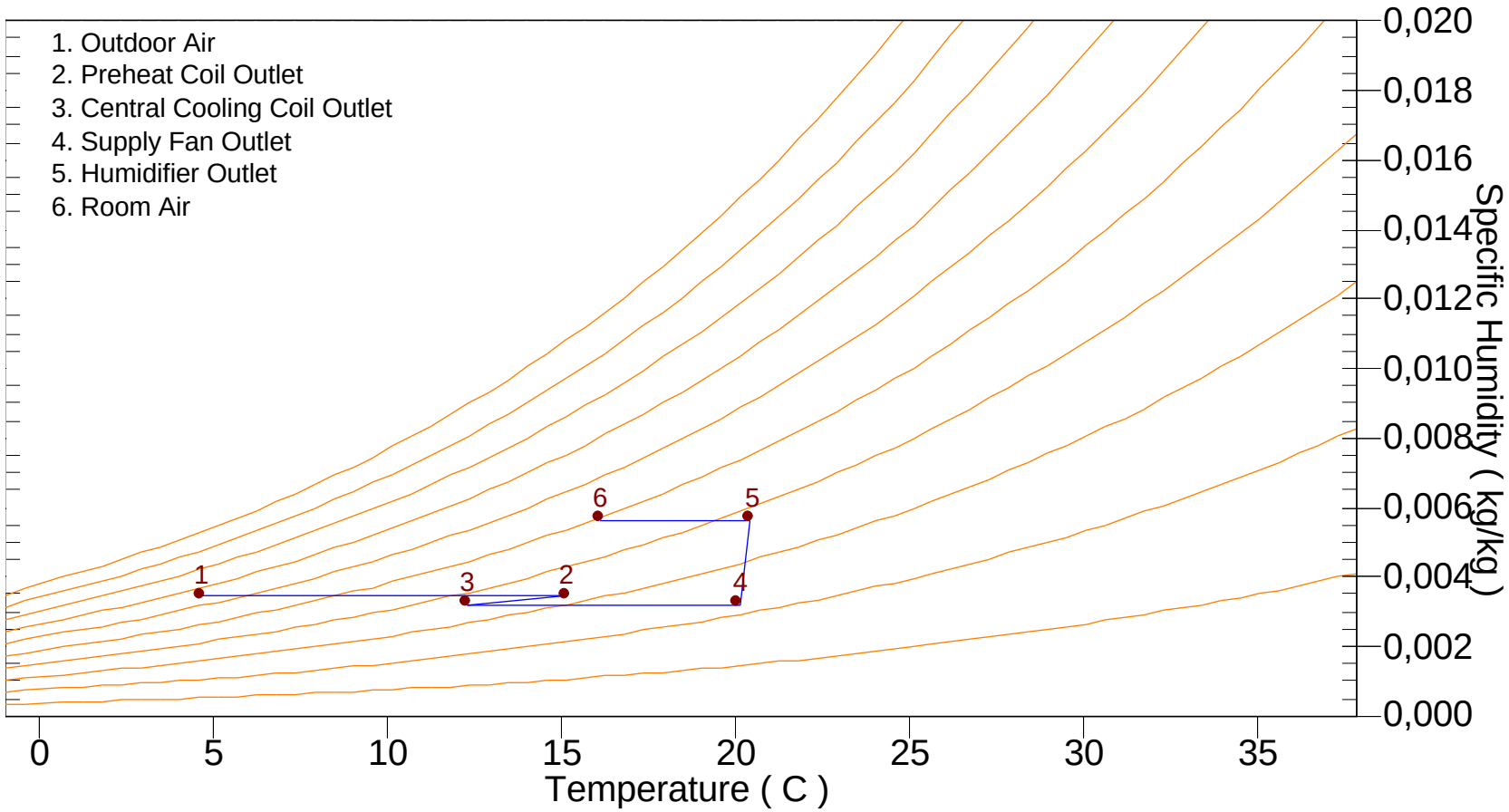
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.2.01 Telecom Room	-1767	Heating	-1767	16,0	167	400	896	0
0.2.02 GSM Room	-312	Heating	-312	16,0	14	400	239	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name	**Civil - Control Building - AHU 0.3 (Battery)**	Number of zones	**1**
Equipment Class	**SPLT AHU**	Floor Area	**152,7** sqm
Air System Type	**SZCAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**119,2**	kW	Peak coil load occurs at	**julho 11:00**	
Sensible coil load	**93,9**	kW	OA DB / WB	**48,6 / 28,2**	C
Coil L/s at peak load	**2486**	L/s	Entering DB / WB	**48,7 / 28,3**	C
Sum of peak zone L/s	**2486**	L/s	Leaving DB / WB	**17,9 / 17,7**	C
Sensible heat ratio	**0,788**		Resulting RH	**61**	%
L/(s kW)	**20,9**		Design supply temp.	**24,3**	C
sqm/kW	**1,3**		Zone T-stat Check	**1 of 1**	OK
W/sqm	**780,5**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 17:00	**72,21**	kg/hr	Air mass flow	**10584,82**	kg/hr
Airflow Rate	**2486**	L/s	Moisture gain	**,00682**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**17,9**	kW	Load occurs at	**maio 10:00**	
Coil L/s at maio 10:00	**2486**	L/s	W/sqm	**117,3**	
Max coil L/s	**2486**	L/s	Ent. DB / Lvg DB	**18,9 / 24,8**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**2486**	L/s	Fan motor BHP	**5,22**	BHP
Design L/(s sqm)	**16,28**	L/(s sqm)	Fan motor kW	**4,14**	kW
			Fan total static	**1000**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**2486**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**16,28**	L/(s sqm)			

Zone Sizing Summary for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name **Civil - Control Building - AHU 0.3 (Battery)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**
Number of zones **1**
Floor Area **152,7** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.3 Battery Room	2486	2486	16,28	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.3 Battery Room	3,9	setembro 15:00	0,0	152,7

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.3 Battery Room						
0.3 Battery Room	3,9	setembro 15:00	2486	0,0	152,7	16,28

Air System Heat Balance Summary for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Table 1. System Loads

	DESIGN COOLING - JULHO 11:00			DESIGN HEATING		
	OA DB / WB 48,6 C / 28,2 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	3069	-324	-	-4364	0
Plenum Load	-	0	0	-	0	0
Return Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	2486 L/s	68236	25379	2486 L/s	8434	0
Supply Fan Load	2486 L/s	4143	-	2486 L/s	-4143	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**75448**	**25055**	**-**	**-73**	**0**
Central Cooling Coil	-	93863	25309	-	0	0
Dehumidification Reheat Coil	-	-16058	-	-	0	-
Humidification	0,00 kg/hr	0	0	0,00 kg/hr	0	0
>> Total Conditioning	**-**	**77805**	**25309**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - JULHO 11:00			DESIGN HEATING		
	OA DB / WB 48,6 C / 28,2 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	41 sqm	555	-	41 sqm	205	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	0 sqm	0	-	0 sqm	0	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	4 sqm	77	-	4 sqm	13	-
Floor Convection	153 sqm	359	-	153 sqm	-28	-
Interior Wall Convection	215 sqm	422	-	215 sqm	-143	-
Ceiling Convection	153 sqm	366	-	153 sqm	-47	-
Overhead Lighting Convection	763 W	323	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	500 W	375	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	248	0	10%	0	0
>> Total Zone Loads	**-**	**2725**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

DESIGN COOLING DAY AT JULHO 11:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	48,7	0,01623	2486	400	68236	25379
Vent - Return Mixing	Outlet	48,7	0,01623	2486	400	-	-
Central Cooling Coil	Outlet	17,9	0,01284	2486	400	93863	25309
Supply Fan	Outlet	19,3	0,01284	2486	400	4143	-
Humidifier	Outlet	24,6	0,01284	2486	400	0	0
Dehumid. Reheat Coil	Outlet	24,6	0,01284	2486	400	16058	-
Cold Supply Duct	Outlet	24,6	0,01284	2486	400	-	-
Zone Air	-	25,6	0,01280	0	400	3069	-324
Zone Direct Exhaust	Outlet	25,6	0,01271	2486	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.3 Battery Room	3069	Cooling	3069	25,6	2486	400	0	0

System Psychrometrics for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

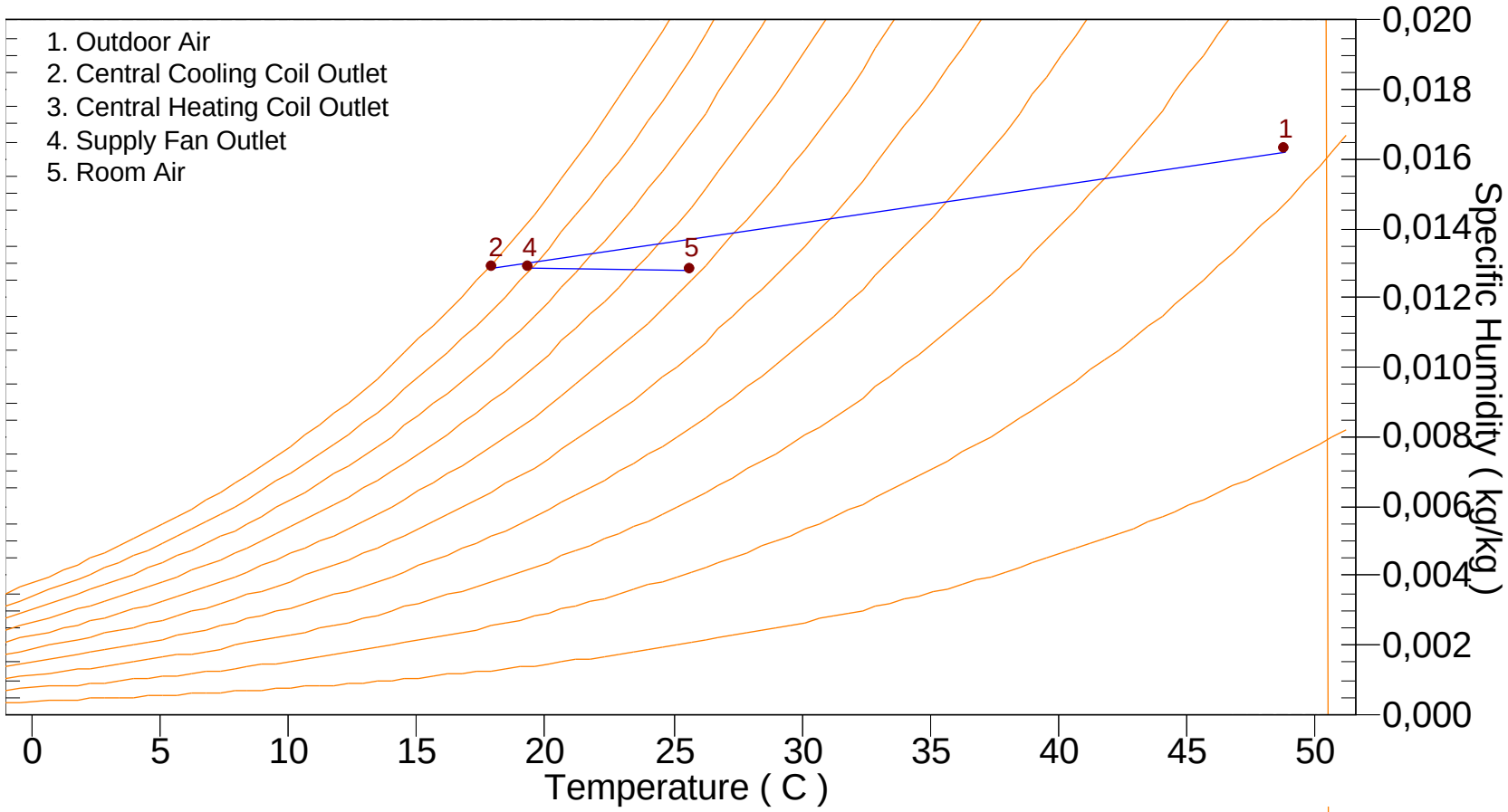
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2486	400	-8434	0
Vent - Return Mixing	Outlet	4,5	0,00343	2486	400	-	-
Central Cooling Coil	Outlet	4,5	0,00343	2486	400	0	0
Supply Fan	Outlet	5,9	0,00343	2486	400	4143	-
Humidifier	Outlet	5,9	0,00343	2486	400	0	0
Dehumid. Reheat Coil	Outlet	5,9	0,00343	2486	400	0	-
Cold Supply Duct	Outlet	5,9	0,00343	2486	400	-	-
Zone Air	-	7,4	0,00343	0	400	4364	0
Zone Direct Exhaust	Outlet	7,4	0,00343	2486	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

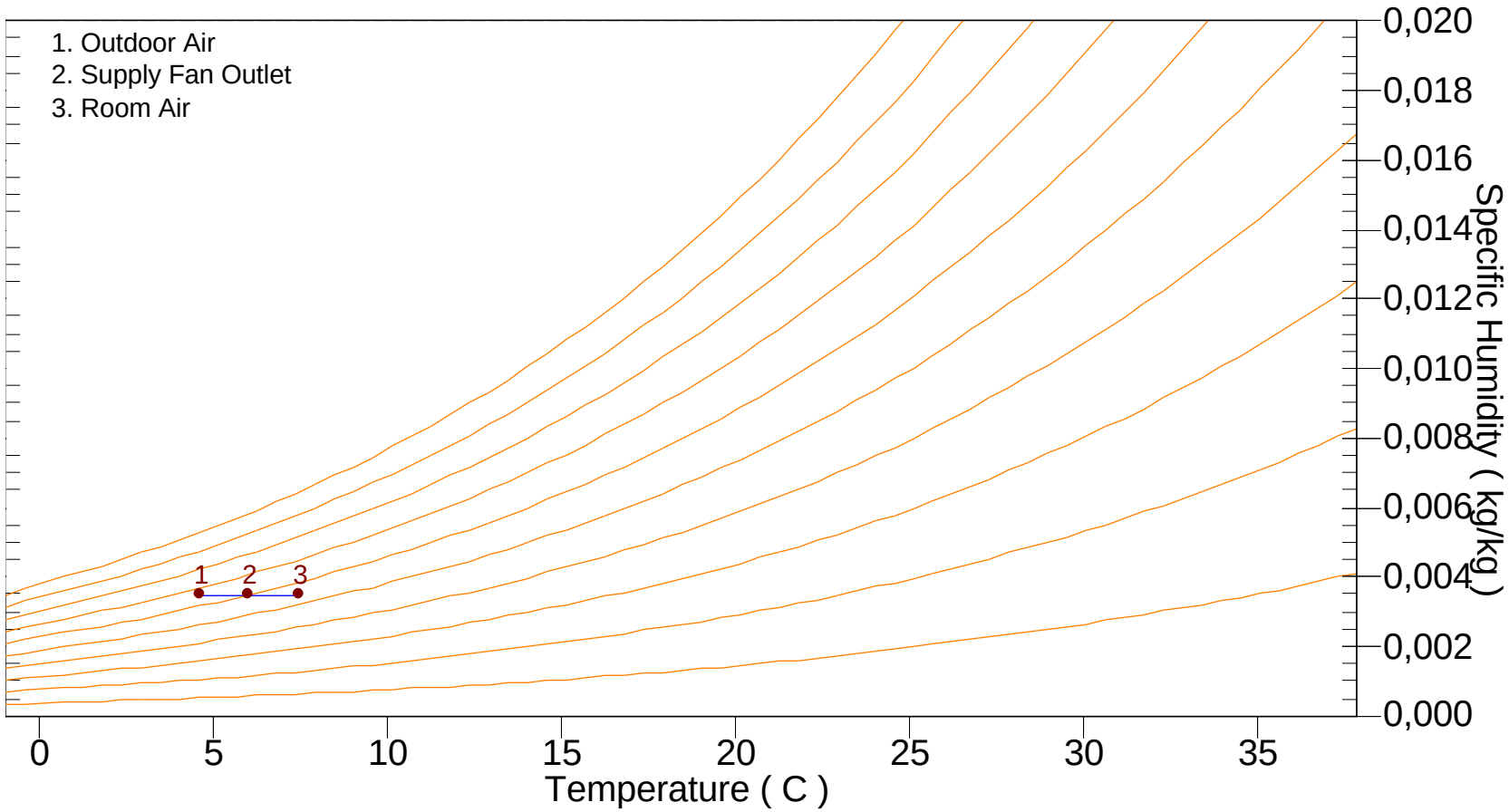
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.3 Battery Room	0	Deadband	4364	7,4	2486	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: julho 11:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name	**Civil - Control Building - AHU 1.1 (Offices 1)**	Number of zones	**18**
Equipment Class	**SPLT AHU**	Floor Area	**1173,4** sqm
Air System Type	**VAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**225,6**	kW	Peak coil load occurs at	**agosto 15:00**		
Sensible coil load	**175,5**	kW	OA DB / WB	**51,7 / 28,9**	C	
Coil L/s at peak load	**7249**	L/s	Entering DB / WB	**34,2 / 22,5**	C	
Sum of peak zone L/s	**7598**	L/s	Leaving DB / WB	**14,3 / 14,2**	C	
Sensible heat ratio	**0,778**		Resulting RH	**54**	%	
L/(s kW)	**32,1**		Design supply temp.	**16,0**	C	
sqm/kW	**5,2**		Zone T-stat Check	**18 of 18**	OK	
W/sqm	**192,2**		Max zone temperature deviation	**0,0**	K	
Water flow @ 5,6 K rise	**N/A**					

Preheat Coil Sizing Data

Max coil load	**21,6**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**5024**	L/s	Ent. DB / Lvg DB	**11,4 / 15,0**	C
Max coil L/s	**7513**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 0:00	**62,15**	kg/hr	Air mass flow	**11507,01**	kg/hr
Airflow Rate	**2703**	L/s	Moisture gain	**,00540**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**17,6**	kW	Load occurs at	**outubro 11:00**	
Coil L/s at outubro 11:00	**6066**	L/s	W/sqm	**15,0**	
Max coil L/s	**7513**	L/s	Ent. DB / Lvg DB	**15,9 / 18,3**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**7513**	L/s	Fan motor BHP	**15,78**	BHP
Design L/s occurs at	**agosto 17:00**		Fan motor kW	**12,52**	kW
Design L/(s sqm)	**6,40**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**7598**	L/s			
VAV Fan Diversity	**1,1**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**2585**	L/s	L/s/person	**63,05**	L/s/person
L/(s sqm)	**2,20**	L/(s sqm)			

Zone Sizing Summary for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name **Civil - Control Building - AHU 1.1 (Offices 1)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **18**
Floor Area **1173,4** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
1.1.01 Corridor (1)	715	361	4,85	8,2	-	0,0	-	0
1.1.02 Lobby (Control Room)	167	167	17,87	3,8	-	0,0	-	0
1.1.03 Toilets M	486	486	9,84	11,0	-	0,0	-	0
1.1.04 Prayer Room M	291	139	8,05	3,1	-	0,0	-	0
1.1.05 Meeting Room (1)	368	153	8,79	3,5	-	0,0	-	0
1.1.06 Office 2	130	28	7,18	0,9	-	0,0	-	0
1.1.07 Office 3	128	28	7,09	0,9	-	0,0	-	0
1.1.08 Office 4	128	28	7,13	0,9	-	0,0	-	0
1.1.09 Office 5	129	28	7,17	0,9	-	0,0	-	0
1.1.10 Kitchen / Tea Prep. (1)	241	83	13,26	1,9	-	0,0	-	0
1.1.11 Pantry (1)	153	153	8,54	3,5	-	0,0	-	0
1.1.12 Storage Room (1)	76	56	5,80	1,3	-	0,0	-	0
1.1.13 Control Room Filing	97	97	4,40	2,2	-	0,0	-	0
1.1.14 Control Room Training	285	42	8,88	1,8	-	0,0	-	0
1.1.15 Control Room	1573	194	4,60	9,9	-	0,0	-	0
1.1.16 Engineering Room	863	167	8,44	5,0	-	0,0	-	0
1.1.17 HVAC Room (1)	1305	167	5,78	0,0	-	0,0	-	0
1.1.18 Corridor (2)	461	167	10,50	4,9	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.1.01 Corridor (1)	8,0	agosto 17:00	5,8	147,3
1.1.02 Lobby (Control Room)	1,2	agosto 15:00	0,7	9,3
1.1.03 Toilets M	2,4	julho 17:00	1,7	49,4
1.1.04 Prayer Room M	2,8	julho 17:00	1,2	36,1
1.1.05 Meeting Room (1)	3,5	julho 17:00	1,5	41,9
1.1.06 Office 2	1,2	julho 17:00	0,7	18,1
1.1.07 Office 3	1,2	julho 17:00	0,7	18,1
1.1.08 Office 4	1,2	julho 17:00	0,7	17,9
1.1.09 Office 5	1,2	julho 17:00	0,7	18,0
1.1.10 Kitchen / Tea Prep. (1)	2,3	julho 17:00	0,7	18,2
1.1.11 Pantry (1)	1,1	julho 18:00	0,6	17,9
1.1.12 Storage Room (1)	0,9	julho 18:00	0,6	13,2
1.1.13 Control Room Filing	0,4	agosto 18:00	0,5	22,1
1.1.14 Control Room Training	2,7	agosto 13:00	1,3	32,1
1.1.15 Control Room	15,0	agosto 16:00	7,3	341,7
1.1.16 Engineering Room	8,2	agosto 17:00	3,7	102,2
1.1.17 HVAC Room (1)	14,6	agosto 17:00	0,0	225,9
1.1.18 Corridor (2)	5,2	agosto 16:00	3,6	43,9

Zone Sizing Summary for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.1.01 Corridor (1)						
1.1.01 Corridor (1)	8,0	agosto 17:00	715	5,8	147,3	4,85
1.1.02 Lobby (Control Room)						
1.1.02 Lobby (Control Room)	1,2	agosto 15:00	167	0,7	9,3	17,87
1.1.03 Toilets M						
1.1.03 Toilets M	2,4	julho 17:00	486	1,7	49,4	9,84
1.1.04 Prayer Room M						
1.1.04 Prayer Room M	2,8	julho 17:00	291	1,2	36,1	8,05
1.1.05 Meeting Room (1)						
1.1.05 Meeting Room (1)	3,5	julho 17:00	368	1,5	41,9	8,79
1.1.06 Office 2						
1.1.06 Office 2	1,2	julho 17:00	130	0,7	18,1	7,18
1.1.07 Office 3						
1.1.07 Office 3	1,2	julho 17:00	128	0,7	18,1	7,09
1.1.08 Office 4						
1.1.08 Office 4	1,2	julho 17:00	128	0,7	17,9	7,13
1.1.09 Office 5						
1.1.09 Office 5	1,2	julho 17:00	129	0,7	18,0	7,17
1.1.10 Kitchen / Tea Prep. (1)						
1.1.10 Kitchen / Tea Prep. (1)	2,3	julho 17:00	241	0,7	18,2	13,26
1.1.11 Pantry (1)						
1.1.11 Pantry (1)	1,1	julho 18:00	153	0,6	17,9	8,54
1.1.12 Storage Room (1)						
1.1.12 Storage Room (1)	0,9	julho 18:00	76	0,6	13,2	5,80
1.1.13 Control Room Filing						
1.1.13 Control Room Filing	0,4	agosto 18:00	97	0,5	22,1	4,40
1.1.14 Control Room Training						
1.1.14 Control Room Training	2,7	agosto 13:00	285	1,3	32,1	8,88
1.1.15 Control Room						
1.1.15 Control Room	15,0	agosto 16:00	1573	7,3	341,7	4,60
1.1.16 Engineering Room						
1.1.16 Engineering Room	8,2	agosto 17:00	863	3,7	102,2	8,44
1.1.17 HVAC Room (1)						
1.1.17 HVAC Room (1)	4,1	julho 17:00	369	0,0	72,3	5,10
1.1.17 HVAC Room (1)	10,5	agosto 17:00	941	0,0	153,6	6,13
1.1.18 Corridor (2)						
1.1.18 Corridor (2)	5,2	agosto 16:00	461	3,6	43,9	10,50

Air System Heat Balance Summary for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	70061	2605	-	33701	-7
Plenum Load	-	0	0	-	0	0
Return Fan Load	4664 L/s	0	-	2439 L/s	0	-
Ventilation Load	2585 L/s	85162	43487	2585 L/s	47125	30901
Supply Fan Load	7249 L/s	12140	-	5024 L/s	-8560	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**167363**	**46092**	**-**	**72265**	**30893**
Central Cooling Coil	-	175516	50048	-	0	0
Preheat Coil	-	0	-	-	21604	-
Dehumidification Reheat Coil	-	-4927	-	-	0	-
Humidification	3,48 kg/hr	-137	-2187	45,34 kg/hr	1795	28444
Terminal Reheat Coils	-	0	-	-	49327	-
>> Total Conditioning	**-**	**170452**	**47860**	**-**	**72726**	**28444**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	620 sqm	20576	-	620 sqm	6930	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	22 sqm	1109	-	22 sqm	540	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	20 sqm	669	-	20 sqm	234	-
Floor Convection	1173 sqm	9889	-	1173 sqm	5786	-
Interior Wall Convection	1289 sqm	5510	-	1289 sqm	3714	-
Ceiling Convection	1173 sqm	21219	-	1173 sqm	11800	-
Overhead Lighting Convection	5867 W	2482	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	2351 W	1763	-	0 W	0	-
People Convection	41	883	2463	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	6410	246	10%	2900	0
>> Total Zone Loads	**-**	**70510**	**2710**	**-**	**31905**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	2585	400	85162	43487
Vent - Return Mixing	Outlet	34,2	0,01251	7249	457	-	-
Preheat Coil	Outlet	34,2	0,01251	7249	457	0	-
Central Cooling Coil	Outlet	14,3	0,01020	7249	457	175516	50048
Supply Fan	Outlet	15,7	0,01020	7249	457	12140	-
Humidifier	Outlet	16,3	0,01032	7249	457	137	2187
Dehumid. Reheat Coil	Outlet	16,3	0,01020	7249	457	4927	-
Cold Supply Duct	Outlet	16,3	0,01032	7249	457	-	-
Zone Air	-	24,4	0,01042	4664	482	70061	2605
Zone Direct Exhaust	Outlet	23,8	0,01044	2585	487	-	-
Return Air	Outlet	24,5	0,01044	4664	488	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.1.01 Corridor (1)	7046	Cooling	7046	25,4	638	457	0	0
1.1.02 Lobby (Control Room)	0	Deadband	1402	23,2	167	457	0	0
1.1.03 Toilets M	0	Deadband	3364	22,0	486	457	0	0
1.1.04 Prayer Room M	2593	Cooling	2595	24,0	277	655	0	0
1.1.05 Meeting Room (1)	3305	Cooling	3307	24,0	354	612	0	0
1.1.06 Office 2	1151	Cooling	1151	24,0	123	501	0	0
1.1.07 Office 3	1138	Cooling	1138	24,0	122	502	0	0
1.1.08 Office 4	1132	Cooling	1133	24,0	121	502	0	0
1.1.09 Office 5	1145	Cooling	1145	24,0	123	502	0	0
1.1.10 Kitchen / Tea Prep. (1)	2167	Cooling	2168	24,0	232	575	0	0
1.1.11 Pantry (1)	0	Deadband	1136	22,4	153	457	0	0
1.1.12 Storage Room (1)	687	Cooling	687	25,4	62	457	0	0
1.1.13 Control Room Filing	0	Deadband	769	22,8	97	457	0	0
1.1.14 Control Room Training	2539	Cooling	2540	24,0	272	497	0	0
1.1.15 Control Room	14209	Cooling	14210	24,0	1521	475	0	0
1.1.16 Engineering Room	7484	Cooling	7485	24,0	801	491	0	0
1.1.17 HVAC Room (1)	13688	Cooling	13688	25,4	1239	457	0	0
1.1.18 Corridor (2)	5104	Cooling	5095	25,4	461	457	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

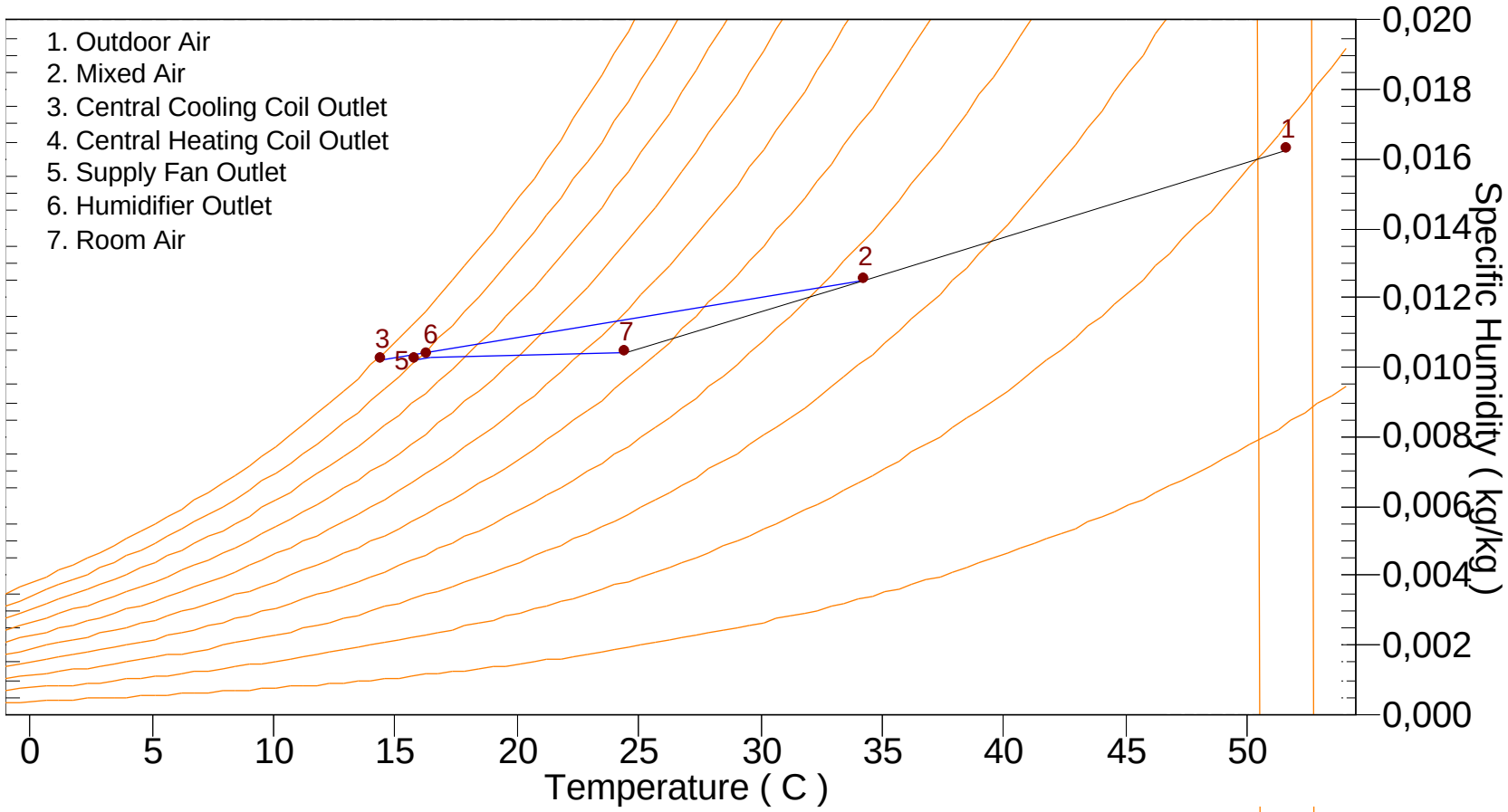
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2585	400	-47125	-30901
Vent - Return Mixing	Outlet	11,4	0,00543	5024	400	-	-
Preheat Coil	Outlet	15,0	0,00543	5024	400	21604	-
Central Cooling Coil	Outlet	15,0	0,00543	5024	400	0	0
Supply Fan	Outlet	16,4	0,00543	5024	400	8560	-
Humidifier	Outlet	16,7	0,00755	5024	400	1795	28444
Dehumid. Reheat Coil	Outlet	16,4	0,00543	5024	400	0	-
Cold Supply Duct	Outlet	16,7	0,00755	5024	400	-	-
Zone Air	-	18,1	0,00755	2439	400	-33701	7
Zone Direct Exhaust	Outlet	19,8	0,00755	2585	400	-	-
Return Air	Outlet	18,7	0,00755	2439	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

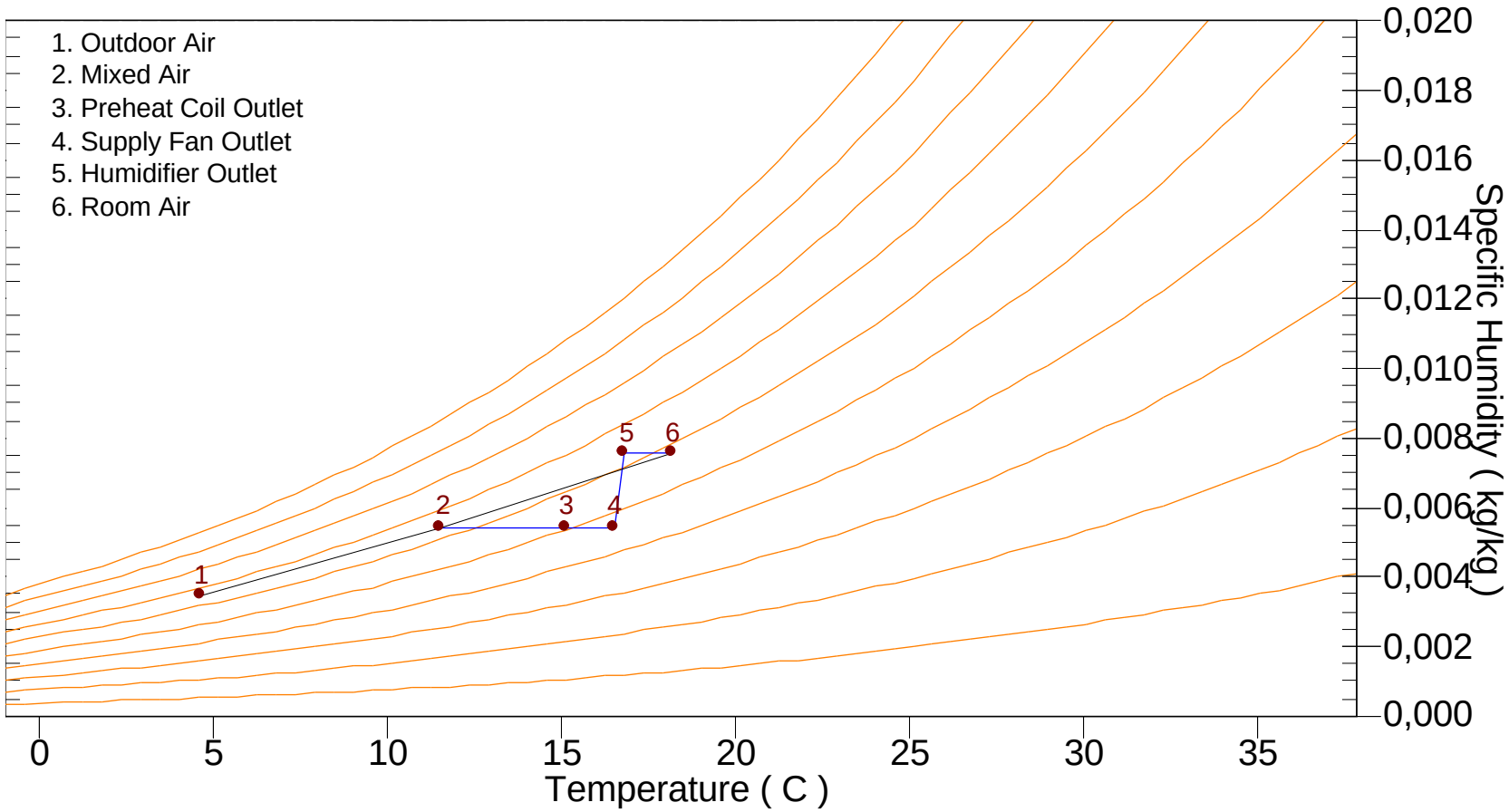
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.1.01 Corridor (1)	-10207	Heating	-5765	20,2	570	400	8151	0
1.1.02 Lobby (Control Room)	-858	Heating	-859	21,0	167	400	1722	0
1.1.03 Toilets M	-2128	Heating	-2128	21,0	486	400	4642	0
1.1.04 Prayer Room M	-1467	Heating	-1468	21,0	139	400	2187	0
1.1.05 Meeting Room (1)	-1739	Heating	-1739	21,0	153	400	2530	0
1.1.06 Office 2	-1576	Heating	-608	19,7	85	400	912	0
1.1.07 Office 3	-1810	Heating	-594	19,4	96	400	902	0
1.1.08 Office 4	-1791	Heating	-590	19,4	95	400	897	0
1.1.09 Office 5	-1576	Heating	-604	19,7	85	400	906	0
1.1.10 Kitchen / Tea Prep. (1)	-764	Heating	-764	21,0	83	400	1194	0
1.1.11 Pantry (1)	-746	Heating	-746	21,0	153	400	1537	0
1.1.12 Storage Room (1)	-651	Heating	-651	21,0	56	400	940	0
1.1.13 Control Room Filing	-831	Heating	-831	21,0	97	400	1333	0
1.1.14 Control Room Training	-3844	Heating	-1246	19,0	198	400	1785	0
1.1.15 Control Room	-35571	Heating	-7002	18,2	1573	400	9885	0
1.1.16 Engineering Room	-11821	Heating	-3531	18,7	600	400	4960	0
1.1.17 HVAC Room (1)	0	Deadband	-870	12,4	167	400	0	0
1.1.18 Corridor (2)	-3714	Heating	-3707	21,0	220	400	4842	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for Civil - Control Building - AHU 1.2 (Tech)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name	**Civil - Control Building - AHU 1.2 (Tech)**		Number of zones	**7**	
Equipment Class	**SPLT AHU**		Floor Area	**656,0**	sqm
Air System Type	**VAV**		Location	**Middle East**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**		Zone L/s Sizing	**Peak zone sensible load**	
Sizing Data	**Calculated**		Space L/s Sizing	**Individual peak space loads**	

Central Cooling Coil Sizing Data

Total coil load	**127,7**	kW	Peak coil load occurs at	**agosto 15:00**	
Sensible coil load	**112,6**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**6522**	L/s	Entering DB / WB	**29,1 / 20,1**	C
Sum of peak zone L/s	**6610**	L/s	Leaving DB / WB	**14,9 / 14,7**	C
Sensible heat ratio	**0,882**		Resulting RH	**50**	%
L/(s kW)	**51,1**		Design supply temp.	**16,0**	C
sqm/kW	**5,1**		Zone T-stat Check	**7 of 7**	OK
W/sqm	**194,7**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 1:00	**28,66**	kg/hr	Air mass flow	**20473,36**	kg/hr
Airflow Rate	**4808**	L/s	Moisture gain	**,00140**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**6,6**	kW	Load occurs at	**janeiro 9:00**	
Coil L/s at janeiro 9:00	**4794**	L/s	W/sqm	**10,0**	
Max coil L/s	**6576**	L/s	Ent. DB / Lvg DB	**15,6 / 16,8**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**6576**	L/s	Fan motor BHP	**13,82**	BHP
Design L/s occurs at	**agosto 16:00**		Fan motor kW	**10,96**	kW
Design L/(s sqm)	**10,02**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**6610**	L/s			
VAV Fan Diversity	**0,5**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**877**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**1,34**	L/(s sqm)			

Zone Sizing Summary for Civil - Control Building - AHU 1.2 (Tech)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Air System Information

Air System Name **Civil - Control Building - AHU 1.2 (Tech)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **7**
Floor Area **656,0** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
1.2.01 Marshaling Room	982	167	5,54	0,0	-	0,0	-	0
1.2.02 Auxiliary Room	670	167	4,41	0,0	-	0,0	-	0
1.2.03 Server Room	1038	167	20,36	0,0	-	0,0	-	0
1.2.04 UPS Room	2436	167	19,05	0,0	-	0,0	-	0
1.2.05 Security Equipment Room	466	14	19,36	0,0	-	0,0	-	0
1.2.07 Machine Room	257	28	7,16	0,0	-	0,0	-	0
1.2.08 Water Tanks	760	167	8,62	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.2.01 Marshaling Room	11,2	agosto 15:00	0,0	177,2
1.2.02 Auxiliary Room	7,6	agosto 16:00	0,0	151,8
1.2.03 Server Room	11,8	setembro 15:00	0,0	51,0
1.2.04 UPS Room	27,8	setembro 15:00	0,0	127,9
1.2.05 Security Equipment Room	5,3	agosto 18:00	0,0	24,1
1.2.07 Machine Room	2,9	julho 18:00	0,0	35,9
1.2.08 Water Tanks	8,7	agosto 17:00	0,0	88,2

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.2.01 Marshaling Room						
1.2.01 Marshaling Room	11,2	agosto 15:00	982	0,0	177,2	5,54
1.2.02 Auxiliary Room						
1.2.02 Auxiliary Room	7,6	agosto 16:00	670	0,0	151,8	4,41
1.2.03 Server Room						
1.2.03 Server Room	11,8	setembro 15:00	1038	0,0	51,0	20,36
1.2.04 UPS Room						
1.2.04 UPS Room	27,8	setembro 15:00	2436	0,0	127,9	19,05
1.2.05 Security Equipment Room						
1.2.05 Security Equipment Room	5,3	agosto 18:00	466	0,0	24,1	19,36
1.2.07 Machine Room						
1.2.07 Machine Room	2,9	julho 18:00	257	0,0	35,9	7,16
1.2.08 Water Tanks						
1.2.08 Water Tanks	8,7	agosto 17:00	760	0,0	88,2	8,62

Air System Heat Balance Summary for Civil - Control Building - AHU 1.2 (Tech)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:28

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	73655	22	-	-3284	-1
Plenum Load	-	0	0	-	0	0
Return Fan Load	5645 L/s	0	-	0 L/s	0	-
Ventilation Load	877 L/s	27064	14567	877 L/s	6667	3657
Supply Fan Load	6522 L/s	10888	-	877 L/s	-3211	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**111607**	**14589**	**-**	**172**	**3657**
Central Cooling Coil	-	112604	15119	-	0	0
Dehumidification Reheat Coil	-	0	-	-	0	-
Humidification	0,00 kg/hr	0	0	5,36 kg/hr	237	3365
>> Total Conditioning	**-**	**112604**	**15119**	**-**	**237**	**3365**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	240 sqm	8859	-	240 sqm	933	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	16 sqm	879	-	16 sqm	190	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	4 sqm	128	-	4 sqm	4	-
Floor Convection	656 sqm	5304	-	656 sqm	-378	-
Interior Wall Convection	592 sqm	3634	-	592 sqm	-703	-
Ceiling Convection	656 sqm	10386	-	656 sqm	-45	-
Overhead Lighting Convection	3280 W	1387	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	49740 W	37305	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	6788	0	10%	0	0
>> Total Zone Loads	**-**	**74671**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	877	400	27064	14567
Vent - Return Mixing	Outlet	29,1	0,01128	6522	400	-	-
Central Cooling Coil	Outlet	14,9	0,01051	6522	400	112604	15119
Supply Fan	Outlet	16,3	0,01051	6522	400	10888	-
Humidifier	Outlet	16,3	0,01051	6522	400	0	0
Dehumid. Reheat Coil	Outlet	16,3	0,01051	6522	400	0	-
Cold Supply Duct	Outlet	16,3	0,01051	6522	400	-	-
Zone Air	-	25,6	0,01051	5645	400	73655	22
Zone Direct Exhaust	Outlet	25,6	0,01051	877	400	-	-
Return Air	Outlet	25,6	0,01051	5645	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.2.01 Marshaling Room	10901	Cooling	10901	25,6	965	400	0	0
1.2.02 Auxiliary Room	7291	Cooling	7291	25,6	646	400	0	0
1.2.03 Server Room	11708	Cooling	11708	25,6	1037	400	0	0
1.2.04 UPS Room	27514	Cooling	27514	25,6	2436	400	0	0
1.2.05 Security Equipment Room	5248	Cooling	5248	25,6	465	400	0	0
1.2.07 Machine Room	2756	Cooling	2756	25,6	244	400	0	0
1.2.08 Water Tanks	8237	Cooling	8237	25,6	729	400	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

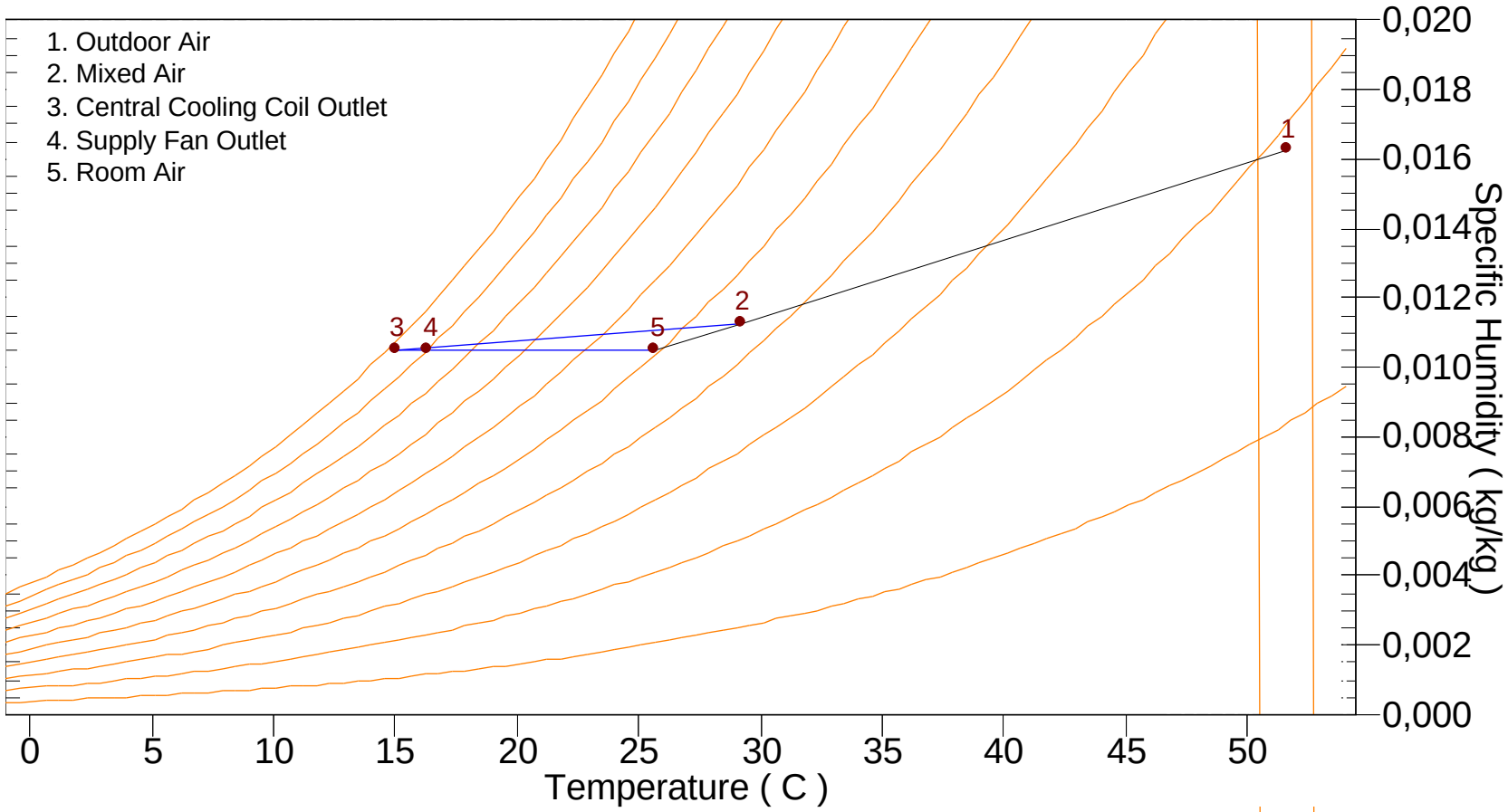
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	877	400	-6667	-3657
Vent - Return Mixing	Outlet	4,5	0,00343	877	400	-	-
Central Cooling Coil	Outlet	4,5	0,00343	877	400	0	0
Supply Fan	Outlet	7,6	0,00343	877	400	3211	-
Humidifier	Outlet	7,8	0,00487	877	400	237	3365
Dehumid. Reheat Coil	Outlet	7,6	0,00343	877	400	0	-
Cold Supply Duct	Outlet	7,8	0,00487	877	400	-	-
Zone Air	-	11,2	0,00487	0	400	3284	1
Zone Direct Exhaust	Outlet	10,9	0,00487	877	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

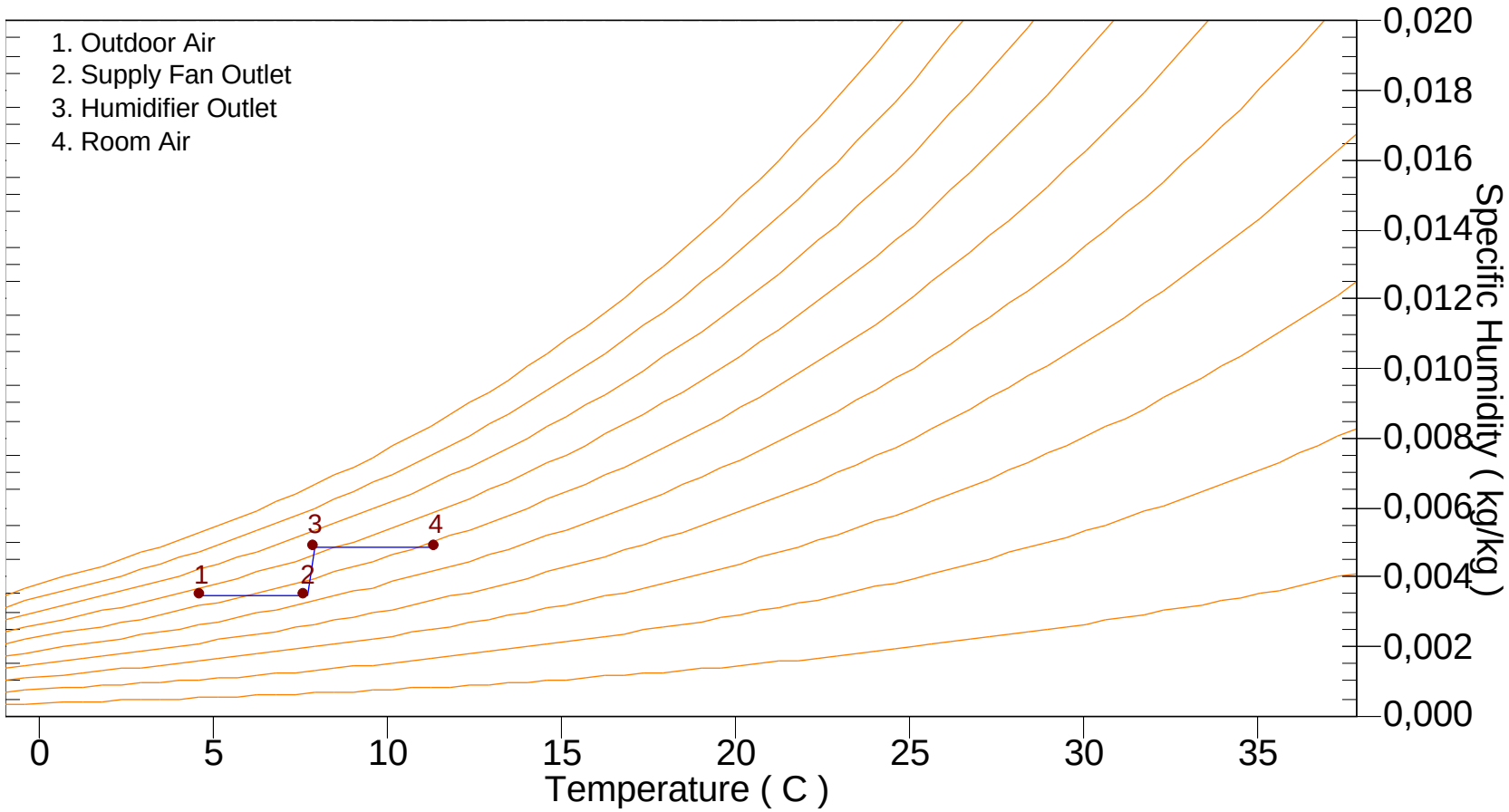
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.2.01 Marshaling Room	0	Deadband	761	11,6	167	400	0	0
1.2.02 Auxiliary Room	0	Deadband	912	12,3	167	400	0	0
1.2.03 Server Room	0	Deadband	568	10,6	167	400	0	0
1.2.04 UPS Room	0	Deadband	716	11,3	167	400	0	0
1.2.05 Security Equipment Room	0	Deadband	98	13,6	14	400	0	0
1.2.07 Machine Room	0	Deadband	108	11,0	28	400	0	0
1.2.08 Water Tanks	0	Deadband	120	8,4	167	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Annual Cost Summary

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Table 1. Annual Costs

Component	Civil - Control Building (€)
Air System Fans	20 295
Cooling	50 111
Heating	79 383
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**149 790**
Lights	5 815
Electric Equipment	37 144
Misc. Electric	5 046
Misc. Fuel Use	0
Non-HVAC Sub-Total	**48 005**
Grand Total	**197 795**

Table 2. Annual Cost per Unit Floor Area

Component	Civil - Control Building (€/sqm)
Air System Fans	6,821
Cooling	16,842
Heating	26,680
Pumps	0,000
Heat Rejection Fans	0,000
HVAC Sub-Total	**50,343**
Lights	1,954
Electric Equipment	12,484
Misc. Electric	1,696
Misc. Fuel Use	0,000
Non-HVAC Sub-Total	**16,134**
Grand Total	**66,476**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	Civil - Control Building (%)
Air System Fans	10,3
Cooling	25,3
Heating	40,1
Pumps	0,0
Heat Rejection Fans	0,0
HVAC Sub-Total	**75,7**
Lights	2,9
Electric Equipment	18,8
Misc. Electric	2,6
Misc. Fuel Use	0,0
Non-HVAC Sub-Total	**24,3**
Grand Total	**100,0**

Table 1. Annual Costs

Component	Civil - Control Building (€)
HVAC Components	
Electric	149 785
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**149 785**
Non-HVAC Components	
Electric	48 005
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**48 005**
Grand Total	**197 790**

Table 2. Annual Energy Consumption

Component	Civil - Control Building
HVAC Components	
Electric (kWh)	2 080 346
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	666 732
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	2 747 078
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	Civil - Control Building
CO2 Equivalent (kg)	988 963

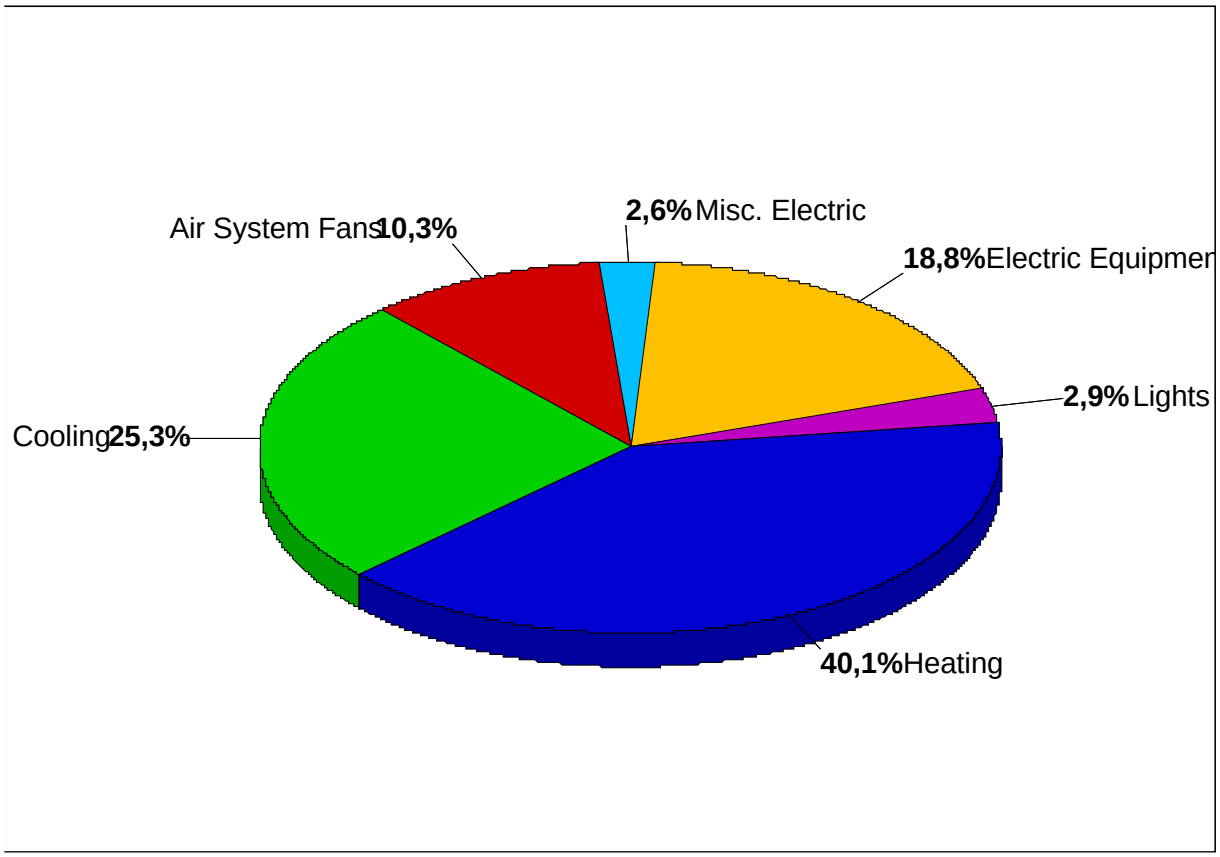
Table 4. Annual Cost per Unit Floor Area

Component	Civil - Control Building (€/sqm)
HVAC Components	
Electric	50,341
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Remote CW	0,000
HVAC Sub-Total	**50,341**
Non-HVAC Components	
Electric	16,134
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Non-HVAC Sub-Total	**16,134**
Grand Total	**66,475**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	Civil - Control Building (%)
HVAC Components	
Electric	75,7
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Remote CW	0,0
HVAC Sub-Total	**75,7**
Non-HVAC Components	
Electric	24,3
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Non-HVAC Sub-Total	**24,3**
Grand Total	**100,0**

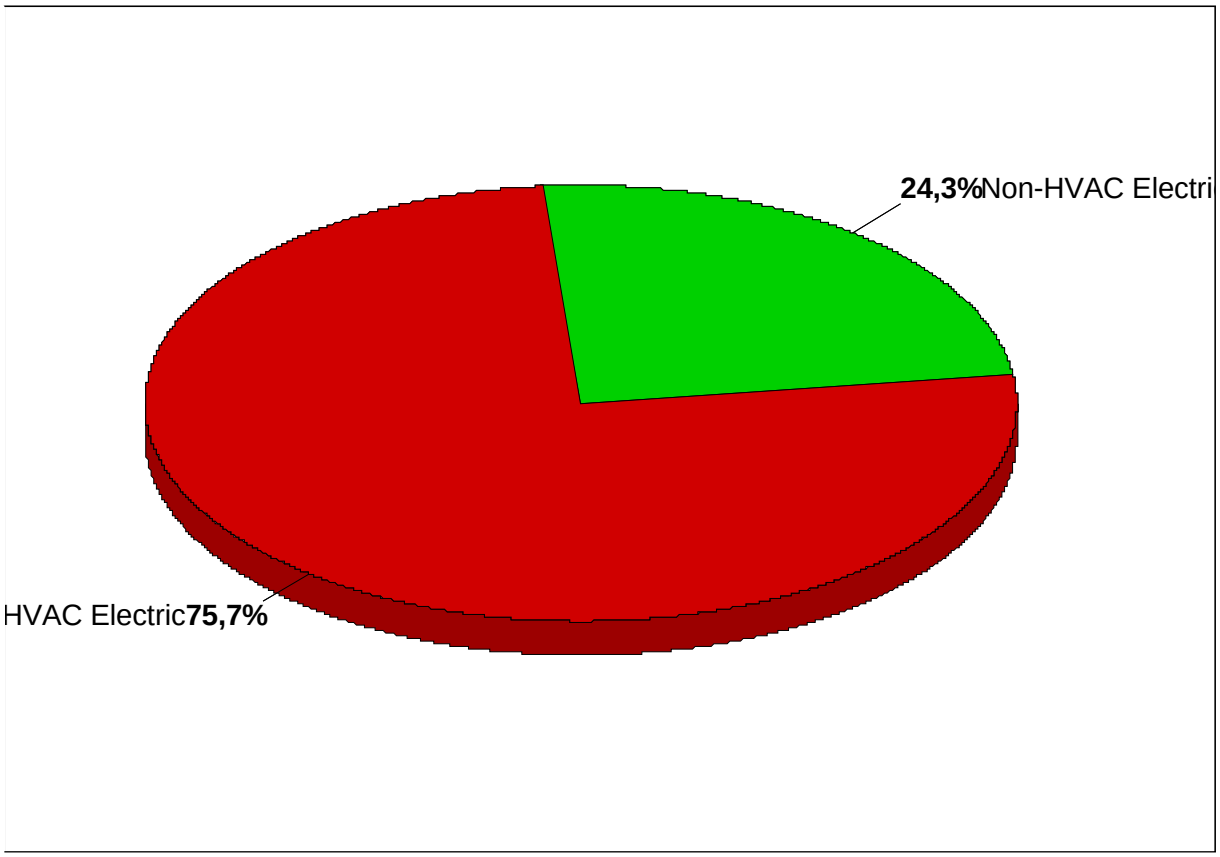


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	20 295	6,821	10,3
Cooling	50 111	16,842	25,3
Heating	79 383	26,680	40,1
Pumps	0	0,000	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**149 790**	**50,343**	**75,7**
Lights	5 815	1,954	2,9
Electric Equipment	37 144	12,484	18,8
Misc. Electric	5 046	1,696	2,6
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**24,3**
Grand Total	**197 795**	**66,476**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

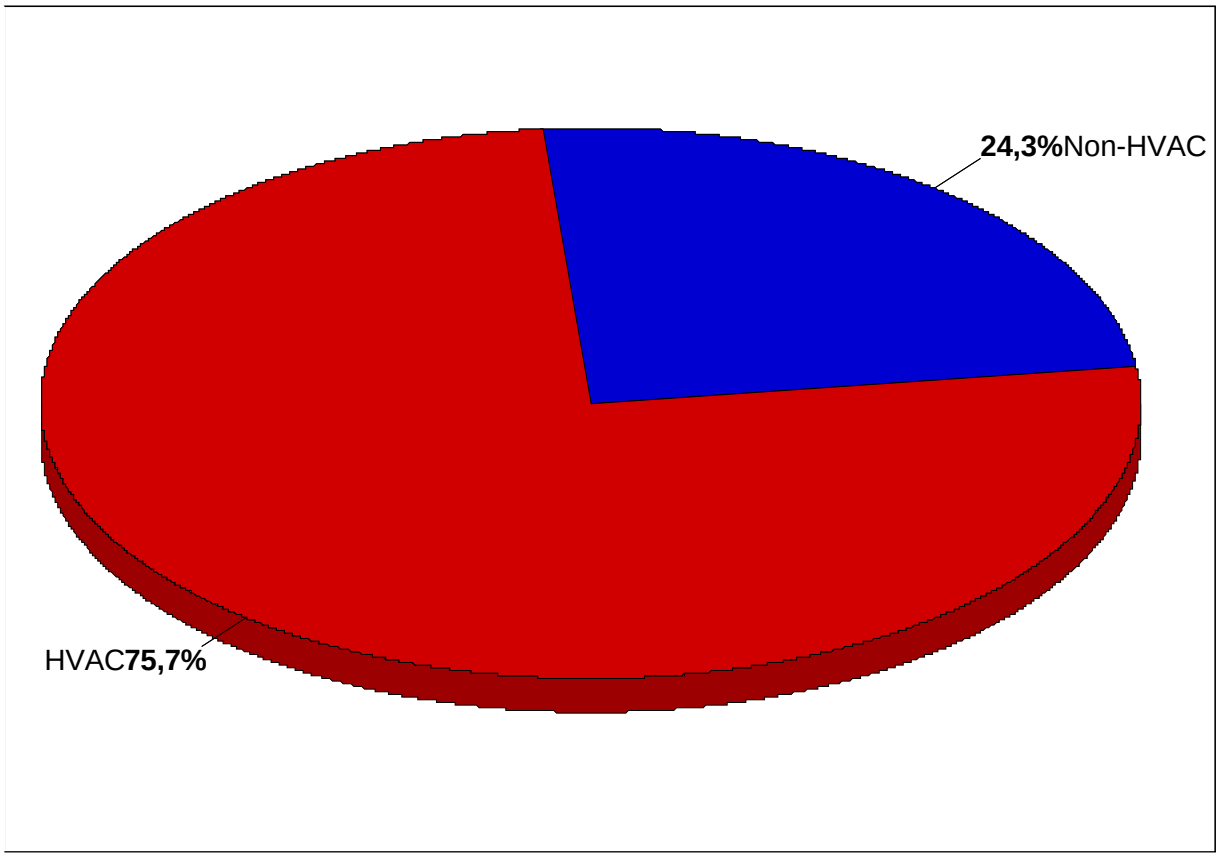


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC Components			
Electric	149 785	50,341	75,7
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Remote Chilled Water	0	0,000	0,0
HVAC Sub-Total	**149 785**	**50,341**	**75,7**
Non-HVAC Components			
Electric	48 005	16,134	24,3
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**24,3**
Grand Total	**197 790**	**66,475**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm



1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC	149 790	50,343	75,7
Non-HVAC	48 005	16,134	24,3
Grand Total	**197 795**	**66,477**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

Energy Budget by System Component - Civil - Control Building

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 997 008	671,172
Heating Coil Loads	1 046 752	351,802
Grand Total	**3 043 760**	**1022,973**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	281 878	94,736	704 696	236,840
Cooling	695 989	233,914	1 739 972	584,785
Heating	1 102 539	370,551	2 756 347	926,377
Pumps	0	0,000	0	0,000
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**2 080 406**	**699,201**	**5 201 015**	**1748,002**
Lights	80 763	27,143	201 907	67,859
Electric Equipment	515 885	173,383	1 289 712	433,457
Misc. Electric	70 078	23,553	175 196	58,881
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 726**	**224,079**	**1 666 814**	**560,197**
Grand Total	**2 747 131**	**923,280**	**6 867 829**	**2308,199**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 997 008	671,172
Heating Coil Loads	1 046 752	351,802
Grand Total	**3 043 760**	**1022,973**

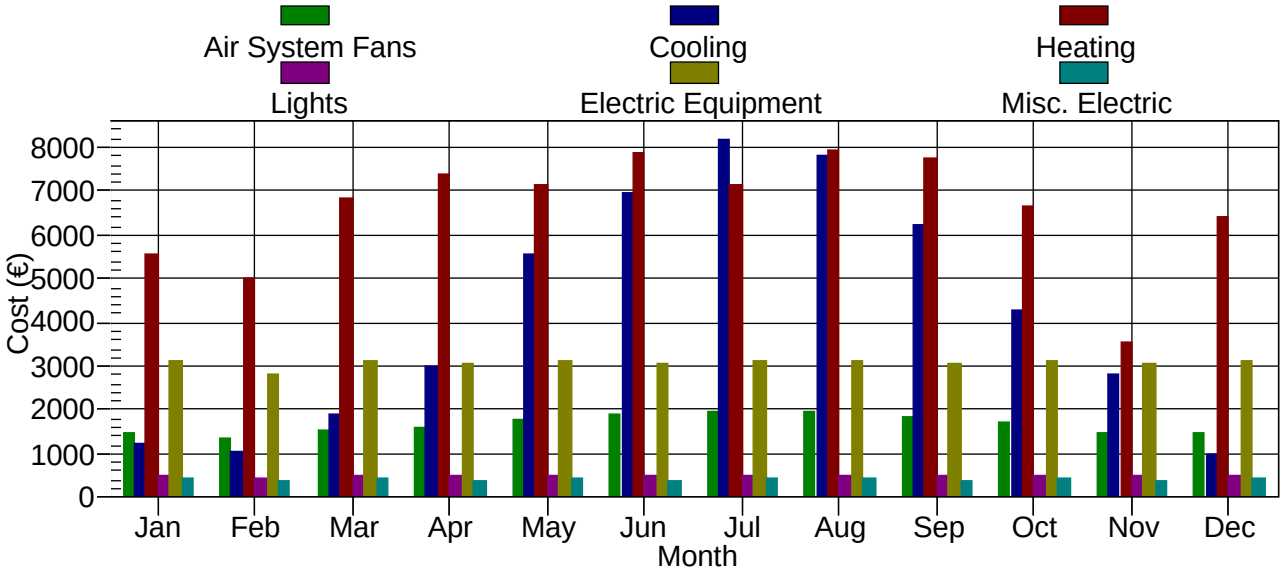
2. Energy Consumption by Energy Source

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
HVAC Components				
Electric	2 080 334	699,177	5 200 835	1747,941
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Remote Chilled Water	0	0,000	0	0,000
HVAC Sub-Total	**2 080 334**	**699,177**	**5 200 835**	**1747,941**
Non-HVAC Components				
Electric	666 728	224,080	1 666 820	560,199
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 728**	**224,080**	**1 666 820**	**560,199**
Grand Total	**2 747 062**	**923,256**	**6 867 655**	**2308,141**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

Monthly Component Costs - Civil - Control Building

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

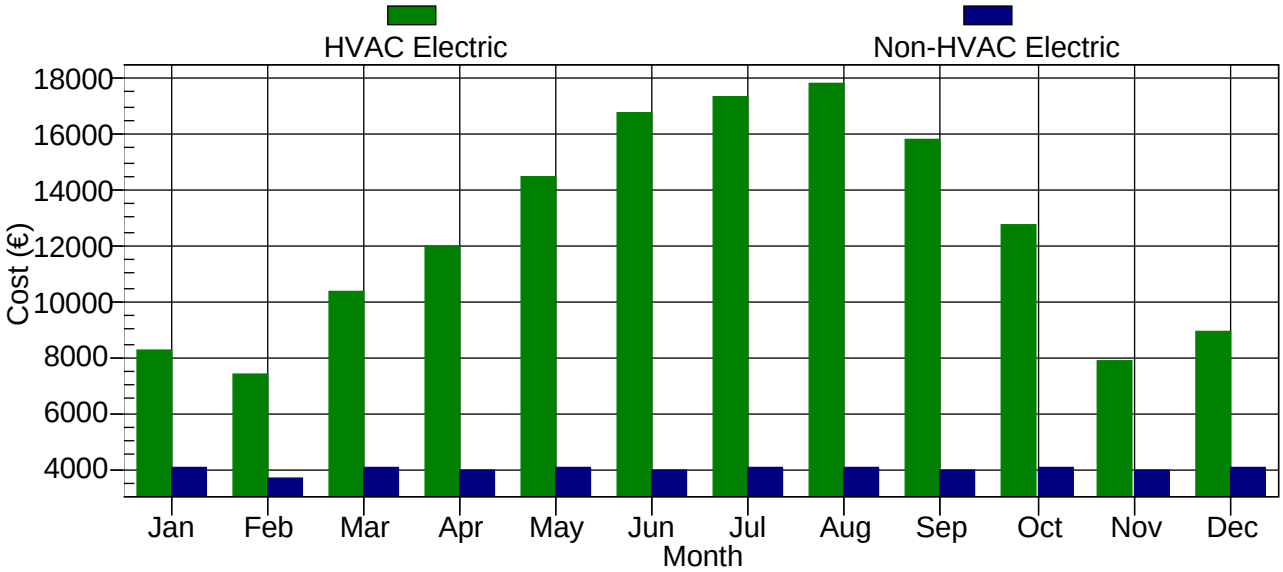


1. HVAC Component Costs

Month	Air System Fans (€)	Cooling (€)	Heating (€)	Pumps (€)	Heat Rejection Fans (€)	HVAC Total (€)
January	1 491	1 217	5 543	0	0	8 251
February	1 372	1 056	5 015	0	0	7 443
March	1 562	1 923	6 843	0	0	10 328
April	1 603	2 984	7 419	0	0	12 006
May	1 805	5 545	7 171	0	0	14 521
June	1 892	6 994	7 884	0	0	16 770
July	1 983	8 203	7 118	0	0	17 304
August	1 991	7 848	7 952	0	0	17 791
September	1 854	6 219	7 765	0	0	15 838
October	1 750	4 288	6 687	0	0	12 725
November	1 488	2 829	3 548	0	0	7 865
December	1 503	1 006	6 437	0	0	8 946
Total	**20 295**	**50 111**	**79 383**	**0**	**0**	**149 790**

2. Non-HVAC Component Costs

Month	Lights (€)	Electric Equipment (€)	Misc. Electric (€)	Misc. Fuel Use (€)	Non-HVAC Total (€)	Grand Total (€)
January	494	3 155	429	0	4 077	12 328
February	446	2 849	387	0	3 683	11 126
March	494	3 155	429	0	4 077	14 405
April	478	3 053	415	0	3 946	15 952
May	494	3 155	429	0	4 077	18 598
June	478	3 053	415	0	3 946	20 716
July	494	3 155	429	0	4 077	21 381
August	494	3 155	429	0	4 077	21 868
September	478	3 053	415	0	3 946	19 784
October	494	3 155	429	0	4 077	16 802
November	478	3 053	415	0	3 946	11 811
December	494	3 155	429	0	4 077	13 023
Total	**5 815**	**37 144**	**5 046**	**0**	**48 005**	**197 795**



1. HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)	Remote Chilled Water (€)
January	8 251	0	0	0	0	0	0
February	7 443	0	0	0	0	0	0
March	10 328	0	0	0	0	0	0
April	12 005	0	0	0	0	0	0
May	14 521	0	0	0	0	0	0
June	16 769	0	0	0	0	0	0
July	17 304	0	0	0	0	0	0
August	17 790	0	0	0	0	0	0
September	15 837	0	0	0	0	0	0
October	12 725	0	0	0	0	0	0
November	7 865	0	0	0	0	0	0
December	8 946	0	0	0	0	0	0
Total	**149 785**	**0**	**0**	**0**	**0**	**0**	**0**

2. Non-HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)
January	4 077	0	0	0	0	0
February	3 683	0	0	0	0	0
March	4 077	0	0	0	0	0
April	3 946	0	0	0	0	0
May	4 077	0	0	0	0	0
June	3 946	0	0	0	0	0
July	4 077	0	0	0	0	0
August	4 077	0	0	0	0	0
September	3 946	0	0	0	0	0
October	4 077	0	0	0	0	0
November	3 946	0	0	0	0	0
December	4 077	0	0	0	0	0
Total	**48 005**	**0**	**0**	**0**	**0**	**0**

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	20714	19055	21697	22263	25066	26283	27546	27659	25753	24307	20662	20874
Cooling												
Electric (kWh)	16897	14661	26712	41439	77021	97141	113930	108999	86369	59559	39294	13971
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	76986	69655	95045	103045	99604	109494	98867	110441	107846	92880	49280	89402
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	6859	6196	6859	6638	6859	6638	6859	6859	6638	6859	6638	6859
Electric Eqpt. (kWh)	43815	39575	43815	42402	43815	42402	43815	43815	42402	43815	42402	43815
Misc. Electric (kWh)	5952	5376	5952	5760	5952	5760	5952	5952	5760	5952	5760	5952
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Energy Use by Energy Type - Civil - Control Building

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	114 597	0	0	0	0	0	0
Feb	103 372	0	0	0	0	0	0
Mar	143 450	0	0	0	0	0	0
Apr	166 740	0	0	0	0	0	0
May	201 679	0	0	0	0	0	0
Jun	232 905	0	0	0	0	0	0
Jul	240 334	0	0	0	0	0	0
Aug	247 089	0	0	0	0	0	0
Sep	219 956	0	0	0	0	0	0
Oct	176 739	0	0	0	0	0	0
Nov	109 238	0	0	0	0	0	0
Dec	124 246	0	0	0	0	0	0
Totals	2 080 346	0	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	56 626	0	0	0	0	0
Feb	51 147	0	0	0	0	0
Mar	56 626	0	0	0	0	0
Apr	54 800	0	0	0	0	0
May	56 626	0	0	0	0	0
Jun	54 800	0	0	0	0	0
Jul	56 626	0	0	0	0	0
Aug	56 626	0	0	0	0	0
Sep	54 800	0	0	0	0	0
Oct	56 626	0	0	0	0	0
Nov	54 800	0	0	0	0	0
Dec	56 626	0	0	0	0	0
Totals	666 732	0	0	0	0	0

1. Component Charges

Billing Period	Energy Charges (€)	Demand Charges (€)	Customer Charges (€)	Taxes (€)	Total Charge (€)
Jan	12 328	0	0	0	12 328
Feb	11 125	0	0	0	11 125
Mar	14 406	0	0	0	14 406
Apr	15 951	0	0	0	15 951
May	18 599	0	0	0	18 599
Jun	20 715	0	0	0	20 715
Jul	21 382	0	0	0	21 382
Aug	21 868	0	0	0	21 868
Sep	19 783	0	0	0	19 783
Oct	16 803	0	0	0	16 803
Nov	11 811	0	0	0	11 811
Dec	13 023	0	0	0	13 023
Totals	197 793	0	0	0	197 793

2. Totals

Billing Period	Total Charges (€)	Total Consumption (kWh)	Avg Price (€/kWh)
Jan	12 328	171 222	0,0720
Feb	11 125	154 517	0,0720
Mar	14 406	200 078	0,0720
Apr	15 951	221 544	0,0720
May	18 599	258 314	0,0720
Jun	20 715	287 714	0,0720
Jul	21 382	296 967	0,0720
Aug	21 868	303 723	0,0720
Sep	19 783	274 765	0,0720
Oct	16 803	233 370	0,0720
Nov	11 811	164 035	0,0720
Dec	13 023	180 870	0,0720
Totals	197 793	2 747 120	0,0720

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	171 222
Feb	0	0	0	0	154 517
Mar	0	0	0	0	200 078
Apr	0	0	0	0	221 544
May	0	0	0	0	258 314
Jun	0	0	0	0	287 714
Jul	0	0	0	0	296 967
Aug	0	0	0	0	303 723
Sep	0	0	0	0	274 765
Oct	0	0	0	0	233 370
Nov	0	0	0	0	164 035
Dec	0	0	0	0	180 870
Totals	0	0	0	0	2 747 120

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	320,3
Feb	0,0	0,0	0,0	0,0	316,9
Mar	0,0	0,0	0,0	0,0	370,9
Apr	0,0	0,0	0,0	0,0	397,6
May	0,0	0,0	0,0	0,0	462,4
Jun	0,0	0,0	0,0	0,0	499,9
Jul	0,0	0,0	0,0	0,0	514,8
Aug	0,0	0,0	0,0	0,0	520,0
Sep	0,0	0,0	0,0	0,0	475,6
Oct	0,0	0,0	0,0	0,0	433,1
Nov	0,0	0,0	0,0	0,0	357,3
Dec	0,0	0,0	0,0	0,0	315,8

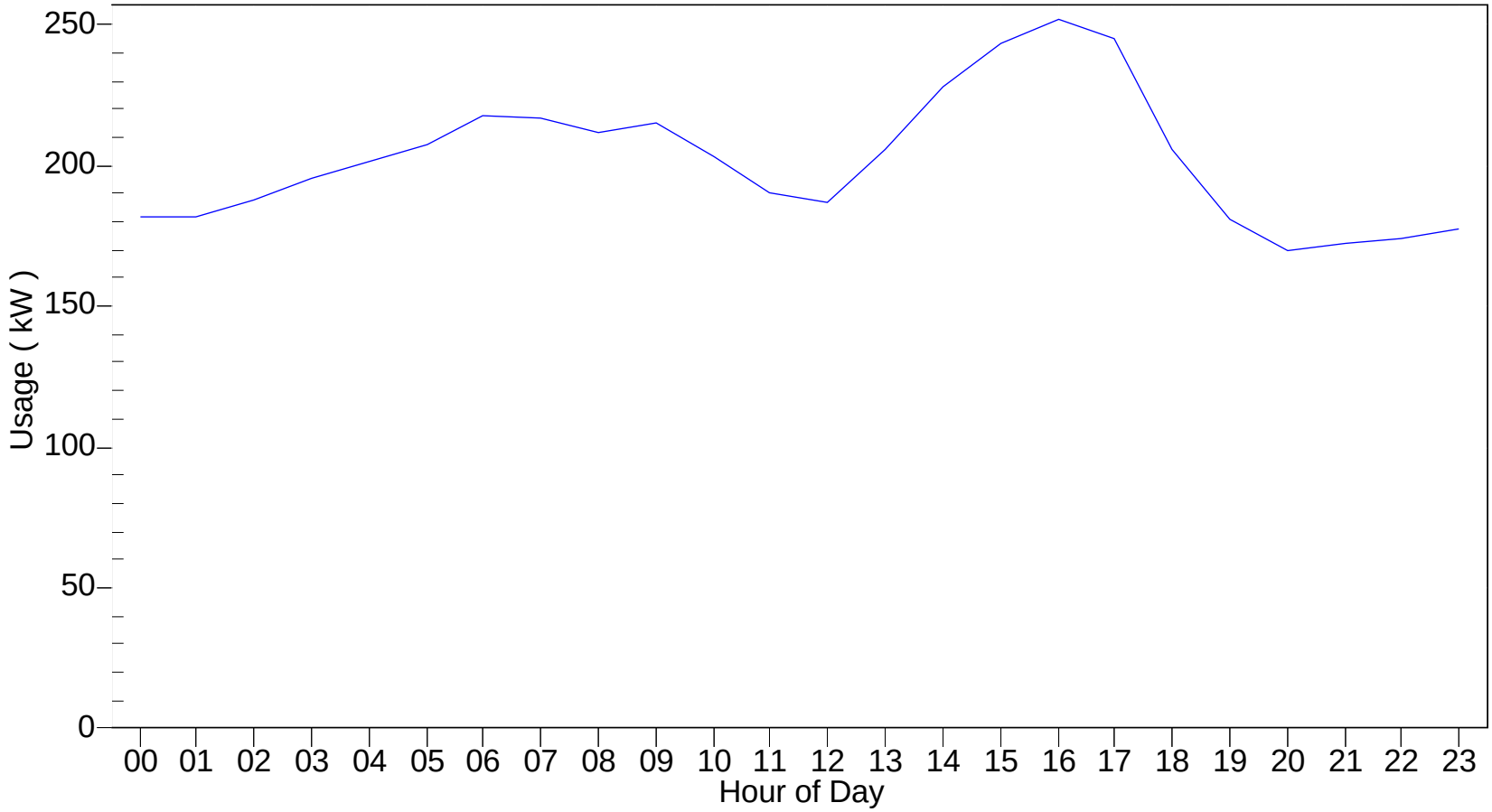
5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	320,3
Feb	0,0	0,0	0,0	0,0	316,9
Mar	0,0	0,0	0,0	0,0	370,9
Apr	0,0	0,0	0,0	0,0	397,6
May	0,0	0,0	0,0	0,0	462,4
Jun	0,0	0,0	0,0	0,0	499,9
Jul	0,0	0,0	0,0	0,0	514,8
Aug	0,0	0,0	0,0	0,0	520,0
Sep	0,0	0,0	0,0	0,0	475,6
Oct	0,0	0,0	0,0	0,0	433,1
Nov	0,0	0,0	0,0	0,0	357,3
Dec	0,0	0,0	0,0	0,0	315,8

6. Time Of Maximum Demands (Date/Hour)

Billing Period	Peak	Mid-Peak	Normal Peak	Off-Peak	Overall
Jan	n/a	n/a	n/a	n/a	1/13 06:00
Feb	n/a	n/a	n/a	n/a	2/10 15:00
Mar	n/a	n/a	n/a	n/a	3/16 15:00
Apr	n/a	n/a	n/a	n/a	4/17 15:00
May	n/a	n/a	n/a	n/a	5/29 15:00
Jun	n/a	n/a	n/a	n/a	6/18 16:00
Jul	n/a	n/a	n/a	n/a	7/16 17:00
Aug	n/a	n/a	n/a	n/a	8/4 16:00
Sep	n/a	n/a	n/a	n/a	9/5 15:00
Oct	n/a	n/a	n/a	n/a	10/6 15:00
Nov	n/a	n/a	n/a	n/a	11/10 15:00
Dec	n/a	n/a	n/a	n/a	12/13 13:00

Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)



Monthly Simulation Results for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	2961	2961	5075	1548	1440	1440	8149
February	571	571	4265	1440	77	77	3472
March	210	210	13627	5002	275	275	1187
April	0	0	24662	9401	22	22	95
May	0	0	46977	19195	526	526	44
June	0	0	54133	24839	0	0	0
July	0	0	66345	29493	372	372	20
August	0	0	60544	28037	0	0	0
September	0	0	50238	21825	0	0	0
October	0	0	37750	14319	243	243	67
November	21	21	21320	6654	4377	4377	2607
December	4064	4064	3289	1051	535	535	7028
Total	**7827**	**7827**	**388225**	**162803**	**7867**	**7867**	**22671**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	8149	18624	13426	3002	1821	300
February	3472	21616	15583	2712	1644	271
March	1187	30793	22199	3045	1821	300
April	95	33666	24270	3206	1762	291
May	44	32848	23679	3865	1821	300
June	0	35553	25630	4181	1762	291
July	20	33736	24320	4397	1821	300
August	0	36652	26422	4430	1821	300
September	0	35467	25567	4067	1762	291
October	67	31416	22647	3645	1821	300
November	2607	10703	7716	2924	1762	291
December	7028	25176	18149	3002	1821	300
Total	**22671**	**346251**	**249608**	**42476**	**21437**	**3537**

Zone Temperature Report for Civil - Control Building - AHU 0.1 (Offices 0)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.1.01 Corridor (0)	24,9	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.02 Lobby (North)	24,4	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.03 Lobby (West)	22,0	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.04 Corridor (SW)	24,4	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.05 Corridor (SE)	24,2	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.06 Washroom (Senior Office)	21,7	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.07 Toilets M	21,8	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.08 Toilets F	22,0	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.09 Dinning Room	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.10 Kitchen / Tea Prep (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.11 Pantry (0)	22,3	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.12 Prayer Room F	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.13 Muster Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.14 Senior Office	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.15 Office 1	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.16 Meeting Room (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.17 Storage (East)	25,2	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.18 Storage (West)	24,2	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.19 Storage (Stairs)	24,9	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.20 Senior Store	25,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.21 HVAC Room (0)	25,7	0	0	26,4	8760	4,2	0	0	16,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	0	0	13143	2140	0	0	0
February	0	0	12984	2156	0	0	0
March	0	0	15725	2819	0	0	0
April	0	0	16720	3280	0	0	0
May	0	0	19566	4477	0	0	0
June	0	0	19731	5155	0	0	0
July	0	0	21547	5781	0	0	0
August	0	0	21187	5704	0	0	0
September	0	0	19727	4837	0	0	0
October	0	0	19294	4013	0	0	0
November	0	0	16517	2807	0	0	0
December	0	0	13402	2198	0	0	0
Total	**0**	**0**	**209542**	**45365**	**0**	**0**	**0**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	0	2157	1555	5114	364	5208
February	0	1948	1405	4646	329	4704
March	0	2157	1555	5200	364	5208
April	0	2088	1505	5073	353	5040
May	0	2132	1537	5268	364	5208
June	0	2088	1505	5118	353	5040
July	0	1955	1409	5287	364	5208
August	0	2155	1553	5281	364	5208
September	0	2088	1505	5093	353	5040
October	0	2119	1528	5214	364	5208
November	0	2056	1482	4939	353	5040
December	0	2157	1555	5036	364	5208
Total	**0**	**25100**	**18094**	**61269**	**4290**	**61320**

Zone Temperature Report for Civil - Control Building - AHU 0.2 (Telecom)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.2.01 Telecom Room	20,0	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na
0.2.02 GSM Room	20,0	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Air System Simulation Results (Table 1) :

Month	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)
January	12693	3328	0	0	7363	5308	3083
February	3274	889	0	0	16659	12010	2784
March	3935	1338	0	0	35166	25351	3083
April	7994	3108	0	0	44106	31796	2983
May	27305	10590	0	0	39435	28428	3083
June	32190	14575	0	0	49505	35688	2983
July	42992	18208	0	0	40828	29432	3083
August	36304	16591	0	0	48820	35194	3083
September	27808	12063	0	0	47330	34120	2983
October	16757	6297	0	0	34075	24565	3083
November	42936	11067	28	28	3600	2595	2983
December	3749	1005	0	0	11708	8440	3083
Total	**257936**	**99059**	**29**	**29**	**378595**	**272927**	**36297**

Air System Simulation Results (Table 2) :

Month	Lighting (kWh)	Electric Equipment (kWh)
January	284	372
February	257	336
March	284	372
April	275	360
May	284	372
June	275	360
July	284	372
August	284	372
September	275	360
October	284	372
November	275	360
December	284	372
Total	**3344**	**4380**

Zone Temperature Report for Civil - Control Building - AHU 0.3 (Battery)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:43

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.3 Battery Room	25,9	0	0	26,4	8760	4,2	0	0	5,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	5324	5324	4757	1386	1327	1327	6829
February	1656	1656	5386	1721	74	74	2573
March	654	654	18441	6400	314	314	747
April	0	0	34478	12476	19	19	43
May	0	0	62825	24571	590	590	38
June	0	0	72926	31639	0	0	0
July	0	0	87303	37143	352	352	7
August	0	0	81477	35707	0	0	0
September	0	0	68341	28147	0	0	0
October	0	0	51886	18788	218	218	50
November	294	294	25556	7616	4955	4955	1987
December	6278	6278	4234	1280	693	693	7052
Total	**14208**	**14208**	**517611**	**206872**	**8542**	**8542**	**19326**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	6829	20196	14559	3903	3170	928
February	2573	25314	18248	3570	2863	839
March	747	37702	27179	4223	3170	928
April	43	42197	30420	4765	3068	898
May	38	41286	29763	6036	3170	928
June	0	44692	32219	7042	3068	898
July	7	41480	29903	7496	3170	928
August	0	45847	33052	7540	3170	928
September	0	44560	32124	6695	3068	898
October	50	39458	28446	5610	3170	928
November	1987	11811	8514	3929	3068	898
December	7052	27673	19949	3921	3170	928
Total	**19326**	**422216**	**304375**	**64730**	**37326**	**10931**

Zone Temperature Report for Civil - Control Building - AHU 1.1 (Offices 1)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.1.01 Corridor (1)	25,4	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.02 Lobby (Control Room)	23,6	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.03 Toilets M	22,6	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.04 Prayer Room M	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.05 Meeting Room (1)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.06 Office 2	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.07 Office 3	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.08 Office 4	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.09 Office 5	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.10 Kitchen / Tea Prep. (1)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.11 Pantry (1)	22,9	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.12 Storage Room (1)	25,4	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.13 Control Room Filing	23,2	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.14 Control Room Training	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.15 Control Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.16 Engineering Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.17 HVAC Room (1)	25,4	0	0	26,2	8760	4,2	0	0	16,6	na	na	na	na
1.1.18 Corridor (2)	25,4	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for Civil - Control Building - AHU 1.2 (Tech)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:43

Air System Simulation Results (Table 1) :

Month	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)
January	36938	8496	791	791	21244	15315	5612
February	36236	8455	116	116	19240	13870	5343
March	44711	11153	1	1	21321	15370	6146
April	48907	13174	0	0	20630	14872	6235
May	59898	18188	0	0	20801	14995	6813
June	60674	20933	0	0	20044	14450	6959
July	66928	23305	0	0	18101	13049	7284
August	65267	22961	0	0	19721	14217	7326
September	60303	19498	0	0	20151	14527	6916
October	58459	16142	0	0	20968	15115	6756
November	48807	11151	29	29	20355	14673	5885
December	36564	8437	298	298	21302	15356	5831
Total	**623695**	**181893**	**1233**	**1233**	**243879**	**175810**	**77107**

Air System Simulation Results (Table 2) :

Month	Lighting (kWh)	Electric Equipment (kWh)
January	1220	37007
February	1102	33425
March	1220	37007
April	1181	35813
May	1220	37007
June	1181	35813
July	1220	37007
August	1220	37007
September	1181	35813
October	1220	37007
November	1181	35813
December	1220	37007
Total	**14366**	**435723**

Zone Temperature Report for Civil - Control Building - AHU 1.2 (Tech)

(In Alternative: Civil - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:43

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.2.01 Marshaling Room	25,6	0	0	26,4	8760	4,2	0	0	24,4	na	na	na	na
1.2.02 Auxiliary Room	25,6	0	0	26,4	8760	4,2	0	0	25,0	na	na	na	na
1.2.03 Server Room	25,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.04 UPS Room	25,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.05 Security Equipment Room	25,7	0	0	26,4	8760	4,2	0	0	25,5	na	na	na	na
1.2.07 Machine Room	25,6	0	0	26,4	8760	4,2	0	0	19,4	na	na	na	na
1.2.08 Water Tanks	25,6	0	0	26,4	8760	4,2	0	0	16,6	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Air System Sizing Summary for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name	**HVAC - Control Building - AHU 0.1 (Offices 0)**	Number of zones	**21**	
Equipment Class	**SPLT AHU**	Floor Area	**797,4**	sqm
Air System Type	**VAV**	Location	**Middle East**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**140,5**	kW	Peak coil load occurs at	**agosto 19:00**	
Sensible coil load	**96,5**	kW	OA DB / WB	**46,5 / 27,8**	C
Coil L/s at peak load	**2774**	L/s	Entering DB / WB	**42,6 / 26,3**	C
Sum of peak zone L/s	**2962**	L/s	Leaving DB / WB	**14,2 / 13,9**	C
Sensible heat ratio	**0,687**		Resulting RH	**56**	%
L/(s kW)	**19,7**		Design supply temp.	**16,0**	C
sqm/kW	**5,7**		Zone T-stat Check	**21 of 21**	OK
W/sqm	**176,2**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**23,2**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**2280**	L/s	Ent. DB / Lvg DB	**4,4 / 13,0**	C
Max coil L/s	**2869**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 0:00	**45,25**	kg/hr	Air mass flow	**9707,72**	kg/hr
Airflow Rate	**2280**	L/s	Moisture gain	**,00466**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**12,5**	kW	Load occurs at	**outubro 8:00**	
Coil L/s at outubro 8:00	**2510**	L/s	W/sqm	**15,7**	
Max coil L/s	**2869**	L/s	Ent. DB / Lvg DB	**14,2 / 18,3**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**2869**	L/s	Fan motor BHP	**6,03**	BHP
Design L/s occurs at	**julho 17:00**		Fan motor kW	**4,78**	kW
Design L/(s sqm)	**3,60**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**2962**	L/s			
VAV Fan Diversity	**3,1**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**2280**	L/s	L/s/person	**47,50**	L/s/person
L/(s sqm)	**2,86**	L/(s sqm)			

Zone Sizing Summary for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name **HVAC - Control Building - AHU 0.1 (Offices 0)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **21**
Floor Area **797,4** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.1.01 Corridor (0)	83	83	0,51	1,9	-	0,0	-	0
0.1.02 Lobby (North)	167	167	17,18	3,8	-	0,0	-	0
0.1.03 Lobby (West)	111	111	22,20	2,5	-	0,0	-	0
0.1.04 Corridor (SW)	111	111	4,09	2,5	-	0,0	-	0
0.1.05 Corridor (SE)	111	111	4,05	2,5	-	0,0	-	0
0.1.06 Washroom (Senior Office)	56	56	8,74	1,3	-	0,0	-	0
0.1.07 Toilets M	181	181	10,04	4,1	-	0,0	-	0
0.1.08 Toilets F	167	167	9,25	3,8	-	0,0	-	0
0.1.09 Dinning Room	174	167	5,30	3,8	-	0,0	-	0
0.1.10 Kitchen / Tea Prep (0)	174	83	9,64	1,9	-	0,0	-	0
0.1.11 Pantry (0)	153	153	8,49	3,5	-	0,0	-	0
0.1.12 Prayer Room F	125	83	4,57	1,9	-	0,0	-	0
0.1.13 Muster Room	245	153	3,81	3,5	-	0,0	-	0
0.1.14 Senior Office	119	42	3,28	0,9	-	0,0	-	0
0.1.15 Office 1	61	28	3,35	0,6	-	0,0	-	0
0.1.16 Meeting Room (0)	263	208	5,17	4,7	-	0,0	-	0
0.1.17 Storage (East)	56	56	4,25	1,3	-	0,0	-	0
0.1.18 Storage (West)	69	69	3,88	1,6	-	0,0	-	0
0.1.19 Storage (Stairs)	42	42	4,60	0,9	-	0,0	-	0
0.1.20 Senior Store	42	42	3,25	0,9	-	0,0	-	0
0.1.21 HVAC Room (0)	453	167	2,21	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.1.01 Corridor (0)	0,8	julho 19:00	1,2	162,3
0.1.02 Lobby (North)	0,5	julho 16:00	0,4	9,7
0.1.03 Lobby (West)	0,2	julho 15:00	0,2	5,0
0.1.04 Corridor (SW)	0,4	setembro 13:00	1,1	27,2
0.1.05 Corridor (SE)	0,4	setembro 12:00	0,6	27,4
0.1.06 Washroom (Senior Office)	0,0	julho 19:00	0,0	6,4
0.1.07 Toilets M	0,2	julho 16:00	0,2	18,0
0.1.08 Toilets F	0,3	julho 16:00	0,2	18,1
0.1.09 Dinning Room	1,7	julho 16:00	0,5	32,9
0.1.10 Kitchen / Tea Prep (0)	1,7	julho 16:00	0,2	18,1
0.1.11 Pantry (0)	0,3	julho 19:00	0,2	18,0
0.1.12 Prayer Room F	1,2	julho 17:00	0,5	27,2
0.1.13 Muster Room	2,3	julho 15:00	1,0	64,2
0.1.14 Senior Office	1,1	julho 16:00	0,5	36,1
0.1.15 Office 1	0,6	julho 16:00	0,3	18,1
0.1.16 Meeting Room (0)	2,5	julho 16:00	0,6	50,9
0.1.17 Storage (East)	0,2	julho 19:00	0,2	13,2
0.1.18 Storage (West)	0,2	julho 19:00	0,2	17,8
0.1.19 Storage (Stairs)	0,2	julho 19:00	0,1	9,1
0.1.20 Senior Store	0,2	julho 19:00	0,2	12,9
0.1.21 HVAC Room (0)	5,2	agosto 19:00	0,0	204,8

Zone Sizing Summary for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.1.01 Corridor (0)						
0.1.01 Corridor (0)	0,7	julho 19:00	76	1,0	152,3	0,50
0.1.01 Corridor (0)	0,1	julho 19:00	10	0,2	10,0	1,00
0.1.02 Lobby (North)						
0.1.02 Lobby (North)	0,5	julho 16:00	167	0,4	9,7	17,18
0.1.03 Lobby (West)						
0.1.03 Lobby (West)	0,2	julho 15:00	111	0,2	5,0	22,20
0.1.04 Corridor (SW)						
0.1.04 Corridor (SW)	0,4	setembro 13:00	111	1,1	27,2	4,09
0.1.05 Corridor (SE)						
0.1.05 Corridor (SE)	0,4	setembro 12:00	111	0,6	27,4	4,05
0.1.06 Washroom (Senior Office)						
0.1.06 Washroom (Senior Office)	0,0	julho 19:00	56	0,0	6,4	8,74
0.1.07 Toilets M						
0.1.07 Toilets M	0,2	julho 16:00	181	0,2	18,0	10,04
0.1.08 Toilets F						
0.1.08 Toilets F	0,3	julho 16:00	167	0,2	18,1	9,25
0.1.09 Dinning Room						
0.1.09 Dinning Room	1,7	julho 16:00	174	0,5	32,9	5,30
0.1.10 Kitchen / Tea Prep (0)						
0.1.10 Kitchen / Tea Prep (0)	1,7	julho 16:00	174	0,2	18,1	9,64
0.1.11 Pantry (0)						
0.1.11 Pantry (0)	0,3	julho 19:00	153	0,2	18,0	8,49
0.1.12 Prayer Room F						
0.1.12 Prayer Room F	1,2	julho 17:00	125	0,5	27,2	4,57
0.1.13 Muster Room						
0.1.13 Muster Room	2,3	julho 15:00	245	1,0	64,2	3,81
0.1.14 Senior Office						
0.1.14 Senior Office	1,1	julho 16:00	119	0,5	36,1	3,28
0.1.15 Office 1						
0.1.15 Office 1	0,6	julho 16:00	61	0,3	18,1	3,35
0.1.16 Meeting Room (0)						
0.1.16 Meeting Room (0)	2,5	julho 16:00	263	0,6	50,9	5,17
0.1.17 Storage (East)						
0.1.17 Storage (East)	0,2	julho 19:00	56	0,2	13,2	4,25
0.1.18 Storage (West)						
0.1.18 Storage (West)	0,2	julho 19:00	69	0,2	17,8	3,88
0.1.19 Storage (Stairs)						
0.1.19 Storage (Stairs)	0,2	julho 19:00	42	0,1	9,1	4,60
0.1.20 Senior Store						
0.1.20 Senior Store	0,2	julho 19:00	42	0,2	12,9	3,25
0.1.21 HVAC Room (0)						
0.1.21 HVAC Room (0)	5,2	agosto 19:00	453	0,0	204,8	2,21

Air System Heat Balance Summary for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:32

Table 1. System Loads

	DESIGN COOLING - AGOSTO 19:00			DESIGN HEATING		
	OA DB / WB 46,5 C / 27,8 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	20685	2935	-	10998	6
Plenum Load	-	0	0	-	0	0
Return Fan Load	532 L/s	0	-	0 L/s	0	-
Ventilation Load	2280 L/s	65158	37492	2280 L/s	42928	26977
Supply Fan Load	2774 L/s	4644	-	2280 L/s	-3853	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**90488**	**40427**	**-**	**50073**	**26982**
Central Cooling Coil	-	96490	43993	-	0	0
Preheat Coil	-	0	-	-	23232	-
Dehumidification Reheat Coil	-	-2989	-	-	0	-
Humidification	4,27 kg/hr	-168	-2708	39,59 kg/hr	1608	24836
Terminal Reheat Coils	-	-1632	-	-	25701	-
>> Total Conditioning	**-**	**91701**	**41286**	**-**	**50541**	**24836**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 19:00			DESIGN HEATING		
	OA DB / WB 46,5 C / 27,8 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	398 sqm	3291	-	398 sqm	1161	-
Roof Convection	205 sqm	1992	-	205 sqm	164	-
Window Convection	18 sqm	508	-	18 sqm	411	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	12 sqm	139	-	12 sqm	102	-
Floor Convection	797 sqm	2372	-	797 sqm	1742	-
Interior Wall Convection	1573 sqm	2728	-	1573 sqm	2116	-
Ceiling Convection	593 sqm	2626	-	593 sqm	1969	-
Overhead Lighting Convection	3987 W	1687	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	1346 W	1010	-	0 W	0	-
People Convection	48	1034	2884	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	1739	288	10%	766	0
>> Total Zone Loads	**-**	**19125**	**3172**	**-**	**8431**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

DESIGN COOLING DAY AT AGOSTO 19:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	46,4	0,01622	2280	400	65158	37492
Vent - Return Mixing	Outlet	42,6	0,01526	2774	424	-	-
Preheat Coil	Outlet	42,6	0,01526	2774	424	0	-
Central Cooling Coil	Outlet	14,2	0,00997	2774	424	96490	43993
Supply Fan	Outlet	15,6	0,00997	2774	424	4644	-
Humidifier	Outlet	16,5	0,01033	2774	424	168	2708
Dehumid. Reheat Coil	Outlet	16,5	0,00997	2774	424	2989	-
Cold Supply Duct	Outlet	16,5	0,01033	2774	424	-	-
Zone Air	-	24,2	0,01070	532	488	20685	2935
Zone Direct Exhaust	Outlet	22,8	0,01065	2280	514	-	-
Return Air	Outlet	24,7	0,01083	532	537	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.1.01 Corridor (0)	0	Deadband	761	24,3	81	426	0	0
0.1.02 Lobby (North)	0	Deadband	640	21,0	163	425	246	0
0.1.03 Lobby (West)	0	Deadband	342	21,0	108	425	246	0
0.1.04 Corridor (SW)	0	Deadband	914	23,5	108	424	0	0
0.1.05 Corridor (SE)	0	Deadband	884	23,2	108	424	0	0
0.1.06 Washroom (Senior Office)	0	Deadband	201	21,0	55	425	97	0
0.1.07 Toilets M	0	Deadband	542	21,0	176	425	418	0
0.1.08 Toilets F	0	Deadband	492	21,0	163	425	394	0
0.1.09 Dinning Room	1018	Cooling	1418	23,7	163	762	0	0
0.1.10 Kitchen / Tea Prep (0)	1457	Cooling	1458	24,0	160	597	0	0
0.1.11 Pantry (0)	0	Deadband	580	21,0	149	425	231	0
0.1.12 Prayer Room F	972	Cooling	973	24,0	107	683	0	0
0.1.13 Muster Room	2247	Cooling	2180	24,0	239	655	0	0
0.1.14 Senior Office	856	Cooling	857	24,0	94	541	0	0
0.1.15 Office 1	483	Cooling	483	24,0	53	528	0	0
0.1.16 Meeting Room (0)	2221	Cooling	2224	24,0	244	763	0	0
0.1.17 Storage (East)	0	Deadband	362	22,0	55	424	0	0
0.1.18 Storage (West)	0	Deadband	439	21,9	67	424	0	0
0.1.19 Storage (Stairs)	0	Deadband	256	21,7	41	424	0	0
0.1.20 Senior Store	0	Deadband	289	22,3	41	424	0	0
0.1.21 HVAC Room (0)	4399	Cooling	4400	25,6	399	425	0	0

System Psychrometrics for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

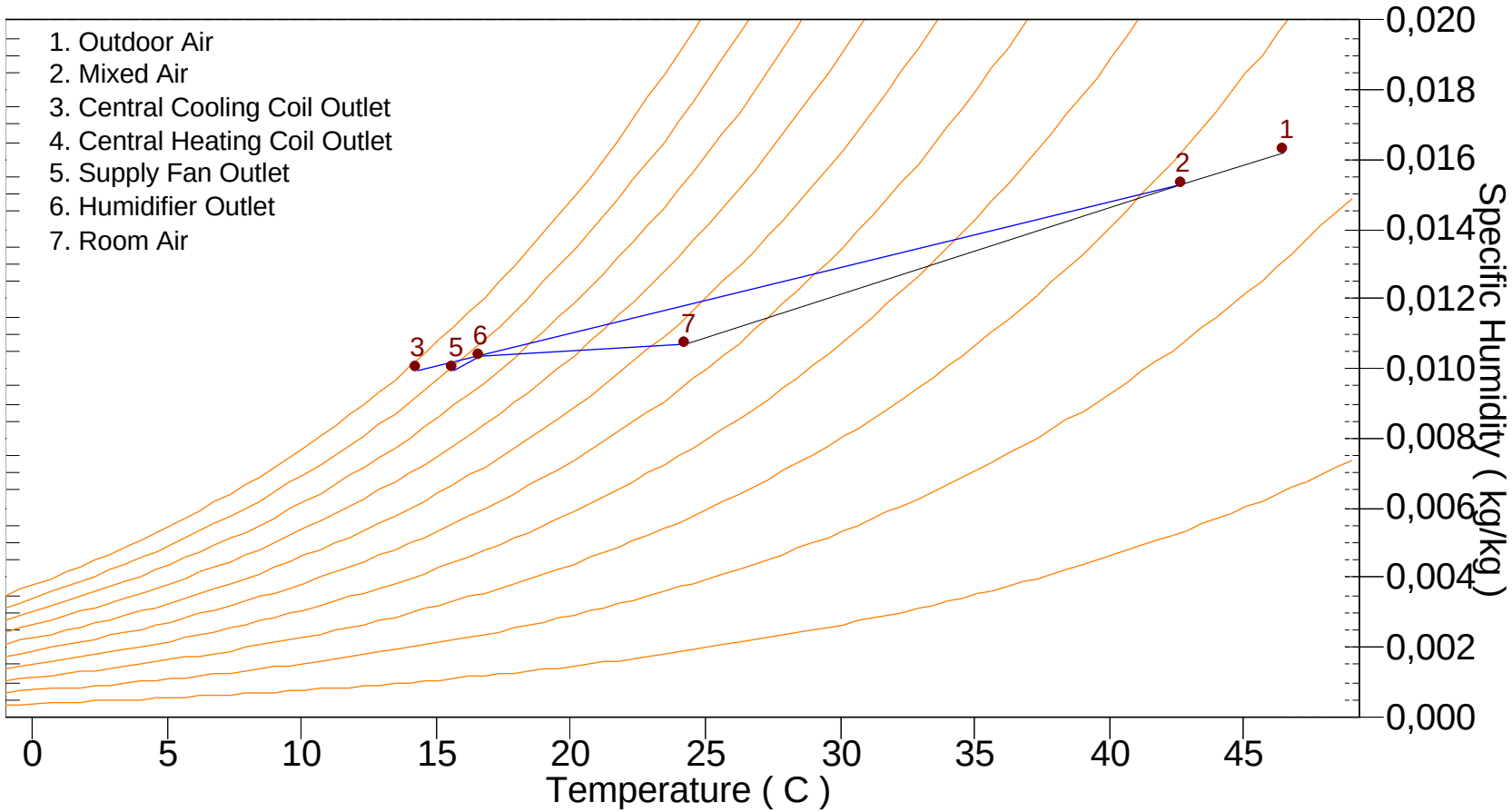
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2280	400	-42928	-26977
Vent - Return Mixing	Outlet	4,5	0,00343	2280	400	-	-
Preheat Coil	Outlet	13,0	0,00343	2280	400	23232	-
Central Cooling Coil	Outlet	13,0	0,00343	2280	400	0	0
Supply Fan	Outlet	14,4	0,00343	2280	400	3853	-
Humidifier	Outlet	15,0	0,00751	2280	400	1608	24836
Dehumid. Reheat Coil	Outlet	14,4	0,00343	2280	400	0	-
Cold Supply Duct	Outlet	15,0	0,00751	2280	400	-	-
Zone Air	-	18,2	0,00751	0	400	-10998	-6
Zone Direct Exhaust	Outlet	20,3	0,00751	2280	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

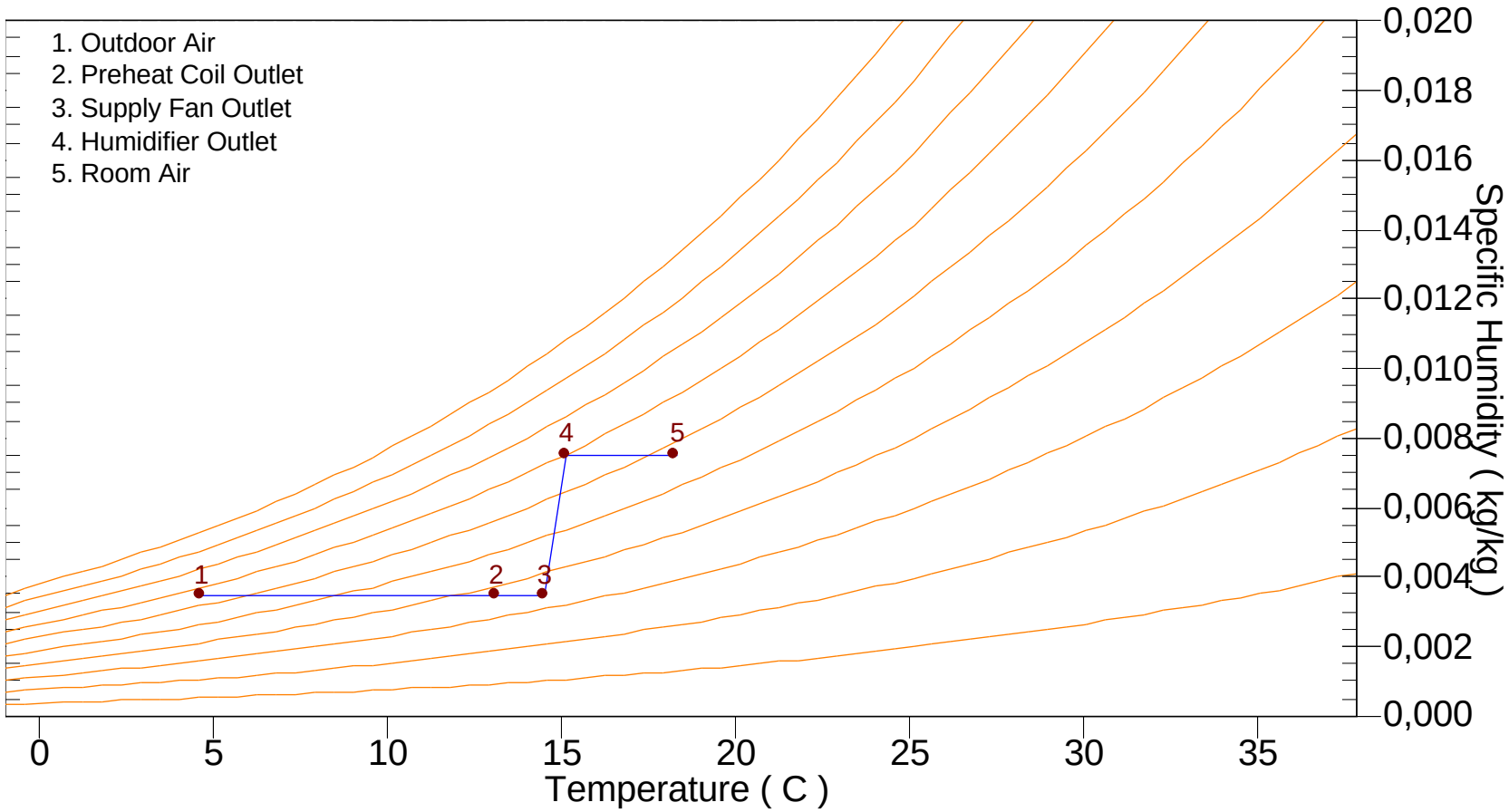
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.1.01 Corridor (0)	-2350	Heating	-1309	20,6	83	400	1874	0
0.1.02 Lobby (North)	-413	Heating	-413	21,0	167	400	1622	0
0.1.03 Lobby (West)	-237	Heating	-237	21,0	111	400	1041	0
0.1.04 Corridor (SW)	-4661	Heating	-1953	19,1	111	400	2506	0
0.1.05 Corridor (SE)	-815	Heating	-815	21,0	111	400	1619	0
0.1.06 Washroom (Senior Office)	-66	Heating	-66	21,0	56	400	472	0
0.1.07 Toilets M	-281	Heating	-281	21,0	181	400	1592	0
0.1.08 Toilets F	-288	Heating	-288	21,0	167	400	1497	0
0.1.09 Dinning Room	-629	Heating	-629	21,0	167	400	1839	0
0.1.10 Kitchen / Tea Prep (0)	-297	Heating	-297	21,0	83	400	898	0
0.1.11 Pantry (0)	-249	Heating	-249	21,0	153	400	1357	0
0.1.12 Prayer Room F	-559	Heating	-559	21,0	83	400	1160	0
0.1.13 Muster Room	-1151	Heating	-1151	21,0	153	400	2259	0
0.1.14 Senior Office	-516	Heating	-516	21,0	42	400	821	0
0.1.15 Office 1	-280	Heating	-280	21,0	28	400	482	0
0.1.16 Meeting Room (0)	-795	Heating	-795	21,0	208	400	2301	0
0.1.17 Storage (East)	-229	Heating	-229	21,0	56	400	635	0
0.1.18 Storage (West)	-244	Heating	-244	21,0	69	400	744	0
0.1.19 Storage (Stairs)	-164	Heating	-164	21,0	42	400	469	0
0.1.20 Senior Store	-210	Heating	-210	21,0	42	400	514	0
0.1.21 HVAC Room (0)	0	Deadband	-314	13,4	167	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 19:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name	**HVAC - Control Building - AHU 0.2 (Telecom)**	Number of zones	**2**
Equipment Class	**SPLT AHU**	Floor Area	**195,9** sqm
Air System Type	**VAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**42,9**	kW	Peak coil load occurs at	**agosto 14:00**	
Sensible coil load	**38,9**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**3374**	L/s	Entering DB / WB	**21,7 / 16,1**	C
Sum of peak zone L/s	**3385**	L/s	Leaving DB / WB	**12,2 / 12,1**	C
Sensible heat ratio	**0,907**		Resulting RH	**60**	%
L/(s kW)	**78,6**		Design supply temp.	**16,0**	C
sqm/kW	**4,6**		Zone T-stat Check	**2 of 2**	OK
W/sqm	**219,2**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**2,3**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**181**	L/s	Ent. DB / Lvg DB	**4,4 / 15,0**	C
Max coil L/s	**3385**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 7:00	**2,88**	kg/hr	Air mass flow	**14064,39**	kg/hr
Airflow Rate	**3303**	L/s	Moisture gain	**,00020**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**10,8**	kW	Load occurs at	**julho 13:00**	
Coil L/s at julho 13:00	**3372**	L/s	W/sqm	**54,9**	
Max coil L/s	**3385**	L/s	Ent. DB / Lvg DB	**13,6 / 16,2**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**3385**	L/s	Fan motor BHP	**7,11**	BHP
Design L/s occurs at	**agosto 17:00**		Fan motor kW	**5,64**	kW
Design L/(s sqm)	**17,28**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**3385**	L/s			
VAV Fan Diversity	**0,0**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**181**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**0,92**	L/(s sqm)			

Zone Sizing Summary for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name **HVAC - Control Building - AHU 0.2 (Telecom)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **2**
Floor Area **195,9** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.2.01 Telecom Room	2674	167	14,88	3,8	-	0,0	-	0
0.2.02 GSM Room	711	14	43,90	0,3	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.2.01 Telecom Room	12,7	agosto 17:00	0,0	179,7
0.2.02 GSM Room	3,4	agosto 18:00	0,0	16,2

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.2.01 Telecom Room						
0.2.01 Telecom Room	12,7	agosto 17:00	2674	0,0	179,7	14,88
0.2.02 GSM Room						
0.2.02 GSM Room	3,4	agosto 18:00	711	0,0	16,2	43,90

Air System Heat Balance Summary for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Table 1. System Loads

	DESIGN COOLING - AGOSTO 14:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	15594	0	-	506	0
Plenum Load	-	0	0	-	0	0
Return Fan Load	3193 L/s	0	-	0 L/s	0	-
Ventilation Load	181 L/s	6807	3866	181 L/s	2926	1599
Supply Fan Load	3374 L/s	5629	-	181 L/s	-1376	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**28029**	**3866**	**-**	**2057**	**1599**
Central Cooling Coil	-	38941	3986	-	-293	-59
Preheat Coil	-	0	-	-	2278	-
Dehumidification Reheat Coil	-	-10668	-	-	0	-
Humidification	0,00 kg/hr	0	0	2,43 kg/hr	92	1526
Terminal Reheat Coils	-	0	-	-	0	-
>> Total Conditioning	**-**	**28273**	**3986**	**-**	**2077**	**1467**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 14:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	59 sqm	950	-	59 sqm	76	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	4 sqm	246	-	4 sqm	62	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	0 sqm	0	-	0 sqm	0	-
Floor Convection	196 sqm	2416	-	196 sqm	-68	-
Interior Wall Convection	169 sqm	2065	-	169 sqm	-61	-
Ceiling Convection	196 sqm	3238	-	196 sqm	-7	-
Overhead Lighting Convection	979 W	414	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	7000 W	5250	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	1458	0	10%	0	0
>> Total Zone Loads	**-**	**16038**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

DESIGN COOLING DAY AT AGOSTO 14:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	181	400	6807	3866
Vent - Return Mixing	Outlet	21,7	0,00927	3374	400	-	-
Preheat Coil	Outlet	21,7	0,00927	3374	400	0	-
Central Cooling Coil	Outlet	12,2	0,00887	3374	400	38941	3986
Supply Fan	Outlet	13,6	0,00887	3374	400	5629	-
Humidifier	Outlet	16,2	0,00887	3374	400	0	0
Dehumid. Reheat Coil	Outlet	16,2	0,00887	3374	400	10668	-
Cold Supply Duct	Outlet	16,2	0,00887	3374	400	-	-
Zone Air	-	20,0	0,00887	3193	400	15594	0
Zone Direct Exhaust	Outlet	20,0	0,00887	181	400	-	-
Return Air	Outlet	20,0	0,00887	3193	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.2.01 Telecom Room	12361	Cooling	12361	20,0	2674	400	0	0
0.2.02 GSM Room	3233	Cooling	3233	20,0	699	400	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

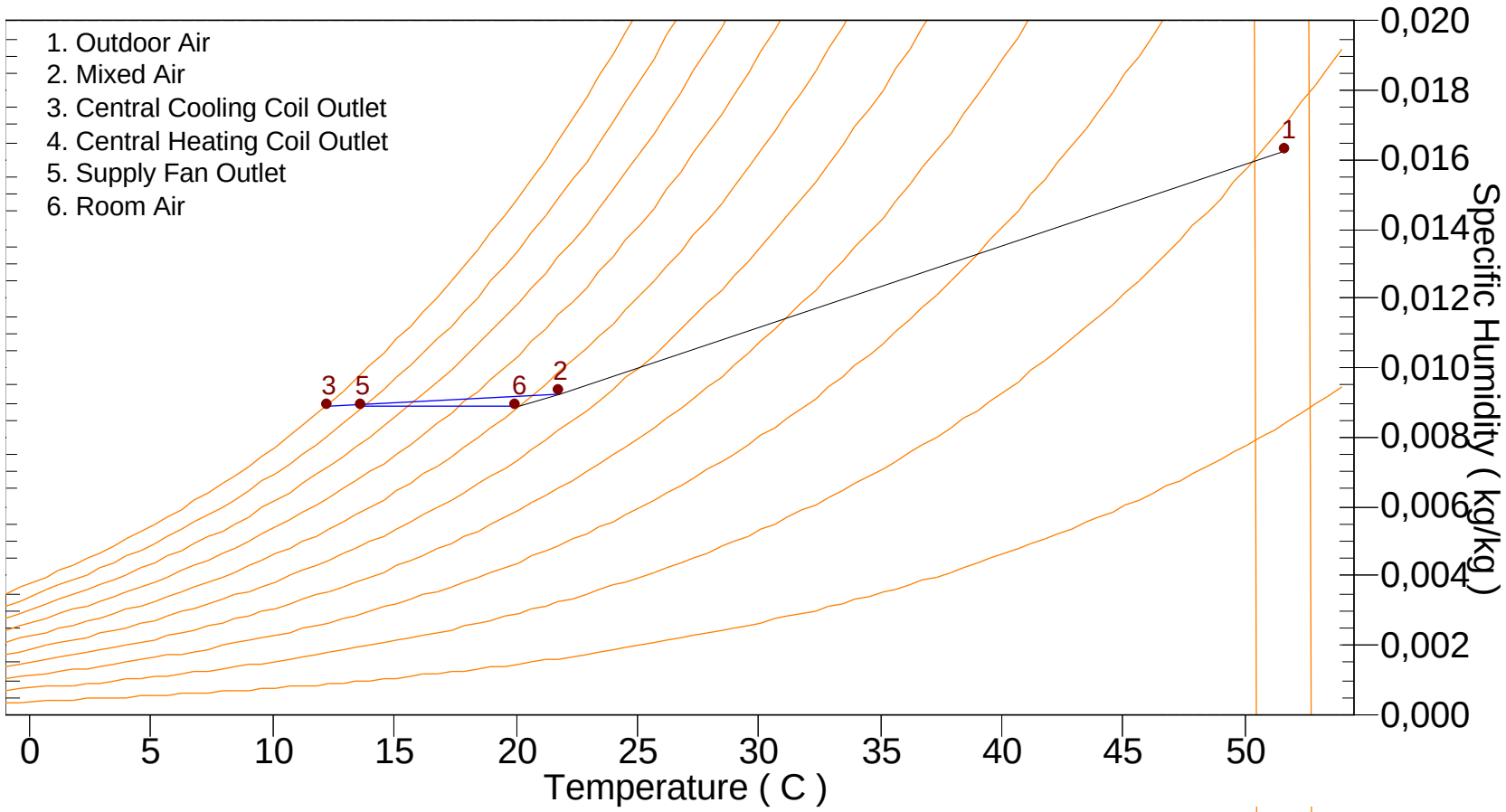
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	181	400	-2926	-1599
Vent - Return Mixing	Outlet	4,5	0,00343	181	400	-	-
Preheat Coil	Outlet	15,0	0,00343	181	400	2278	-
Central Cooling Coil	Outlet	13,7	0,00332	181	400	293	59
Supply Fan	Outlet	20,0	0,00332	181	400	1376	-
Humidifier	Outlet	20,4	0,00648	181	400	92	1526
Dehumid. Reheat Coil	Outlet	20,0	0,00332	181	400	0	-
Cold Supply Duct	Outlet	20,4	0,00648	181	400	-	-
Zone Air	-	18,1	0,00648	0	400	-506	0
Zone Direct Exhaust	Outlet	18,1	0,00648	181	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

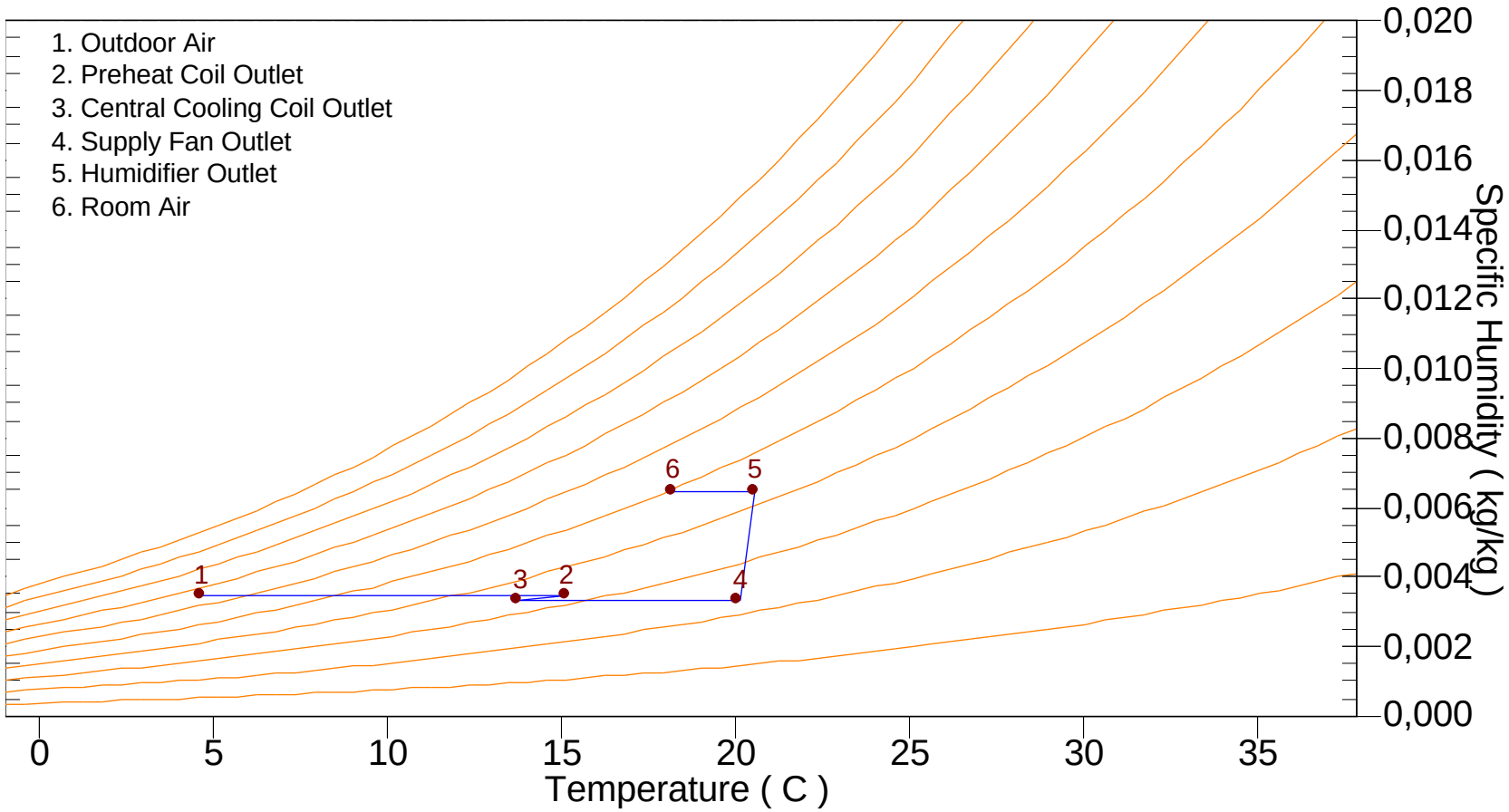
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.2.01 Telecom Room	0	Deadband	-451	18,2	167	400	0	0
0.2.02 GSM Room	0	Deadband	-56	17,1	14	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 14:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name	**HVAC - Control Building - AHU 0.3 (Battery)**	Number of zones	**1**
Equipment Class	**SPLT AHU**	Floor Area	**152,7** sqm
Air System Type	**SZCAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**119,2**	kW	Peak coil load occurs at	**julho 11:00**	
Sensible coil load	**93,9**	kW	OA DB / WB	**48,6 / 28,2**	C
Coil L/s at peak load	**2486**	L/s	Entering DB / WB	**48,7 / 28,3**	C
Sum of peak zone L/s	**2486**	L/s	Leaving DB / WB	**17,9 / 17,7**	C
Sensible heat ratio	**0,788**		Resulting RH	**61**	%
L/(s kW)	**20,9**		Design supply temp.	**25,0**	C
sqm/kW	**1,3**		Zone T-stat Check	**1 of 1**	OK
W/sqm	**780,5**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 17:00	**72,19**	kg/hr	Air mass flow	**10584,82**	kg/hr
Airflow Rate	**2486**	L/s	Moisture gain	**,00682**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**19,3**	kW	Load occurs at	**maio 14:00**	
Coil L/s at maio 14:00	**2486**	L/s	W/sqm	**126,1**	
Max coil L/s	**2486**	L/s	Ent. DB / Lvg DB	**18,8 / 25,1**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**2486**	L/s	Fan motor BHP	**5,22**	BHP
Design L/(s sqm)	**16,28**	L/(s sqm)	Fan motor kW	**4,14**	kW
			Fan total static	**1000**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**2486**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**16,28**	L/(s sqm)			

Zone Sizing Summary for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name **HVAC - Control Building - AHU 0.3 (Battery)**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**
Number of zones **1**
Floor Area **152,7** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
0.3 Battery Room	2486	2486	16,28	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.3 Battery Room	1,7	setembro 15:00	0,0	152,7

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.3 Battery Room						
0.3 Battery Room	1,7	setembro 15:00	2486	0,0	152,7	16,28

Air System Heat Balance Summary for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:32

Table 1. System Loads

	DESIGN COOLING - JULHO 11:00			DESIGN HEATING		
	OA DB / WB 48,6 C / 28,2 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	1511	-324	-	-5493	0
Plenum Load	-	0	0	-	0	0
Return Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	2486 L/s	68236	25379	2486 L/s	9553	0
Supply Fan Load	2486 L/s	4143	-	2486 L/s	-4143	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**73890**	**25055**	**-**	**-83**	**0**
Central Cooling Coil	-	93863	25309	-	0	0
Dehumidification Reheat Coil	-	-17617	-	-	0	-
Humidification	0,00 kg/hr	0	0	0,00 kg/hr	0	0
>> Total Conditioning	**-**	**76246**	**25309**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - JULHO 11:00			DESIGN HEATING		
	OA DB / WB 48,6 C / 28,2 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	41 sqm	145	-	41 sqm	59	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	0 sqm	0	-	0 sqm	0	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	4 sqm	72	-	4 sqm	18	-
Floor Convection	153 sqm	198	-	153 sqm	-16	-
Interior Wall Convection	215 sqm	240	-	215 sqm	-46	-
Ceiling Convection	153 sqm	77	-	153 sqm	-15	-
Overhead Lighting Convection	763 W	323	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	500 W	375	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	143	0	10%	0	0
>> Total Zone Loads	**-**	**1574**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

DESIGN COOLING DAY AT JULHO 11:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	48,7	0,01623	2486	400	68236	25379
Vent - Return Mixing	Outlet	48,7	0,01623	2486	400	-	-
Central Cooling Coil	Outlet	17,9	0,01284	2486	400	93863	25309
Supply Fan	Outlet	19,3	0,01284	2486	400	4143	-
Humidifier	Outlet	25,1	0,01284	2486	400	0	0
Dehumid. Reheat Coil	Outlet	25,1	0,01284	2486	400	17617	-
Cold Supply Duct	Outlet	25,1	0,01284	2486	400	-	-
Zone Air	-	25,6	0,01280	0	400	1511	-324
Zone Direct Exhaust	Outlet	25,6	0,01271	2486	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.3 Battery Room	1511	Cooling	1511	25,6	2486	400	0	0

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

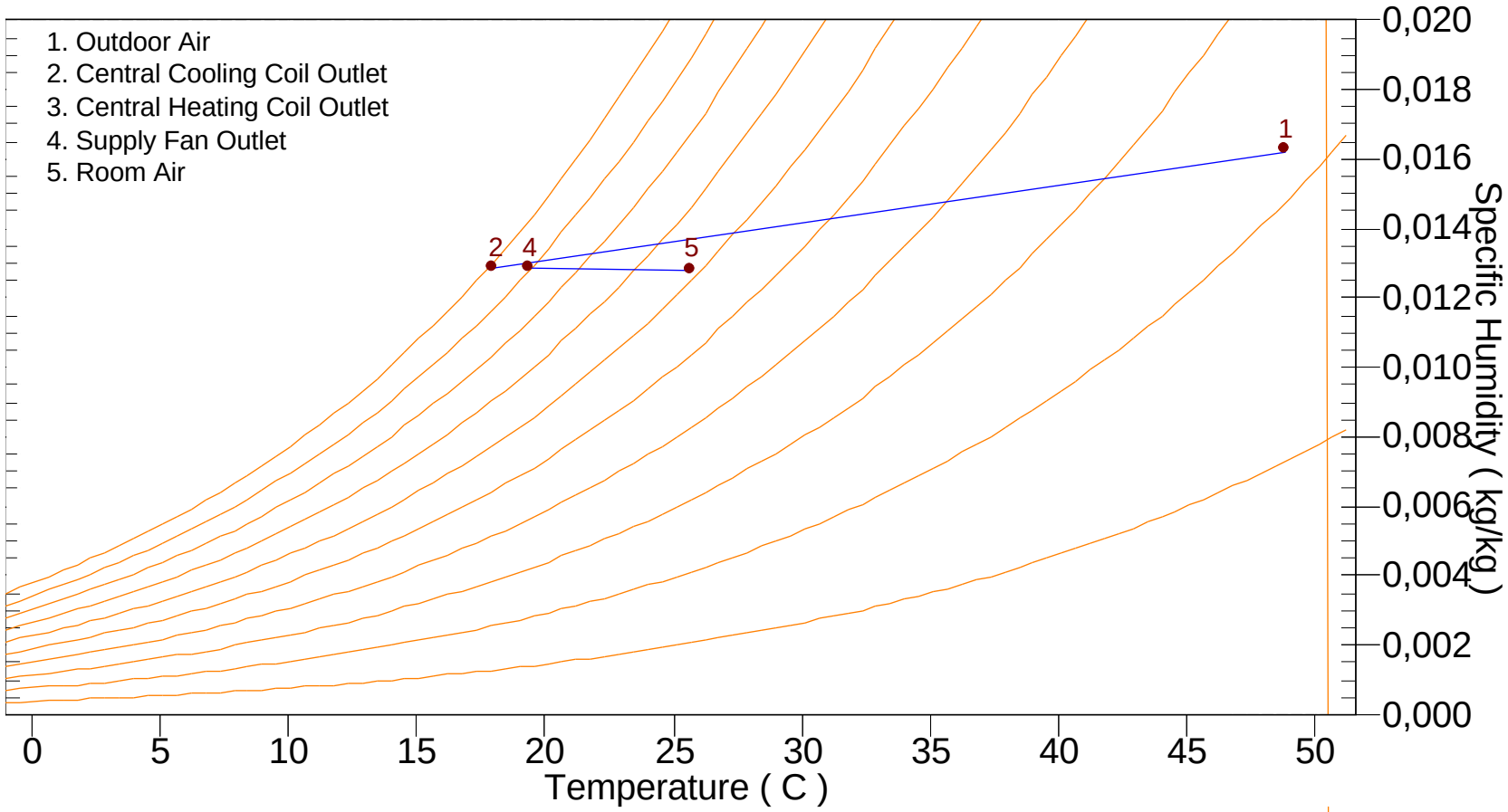
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2486	400	-9553	0
Vent - Return Mixing	Outlet	4,5	0,00343	2486	400	-	-
Central Cooling Coil	Outlet	4,5	0,00343	2486	400	0	0
Supply Fan	Outlet	5,9	0,00343	2486	400	4143	-
Humidifier	Outlet	5,9	0,00343	2486	400	0	0
Dehumid. Reheat Coil	Outlet	5,9	0,00343	2486	400	0	-
Cold Supply Duct	Outlet	5,9	0,00343	2486	400	-	-
Zone Air	-	7,7	0,00343	0	400	5493	0
Zone Direct Exhaust	Outlet	7,7	0,00343	2486	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

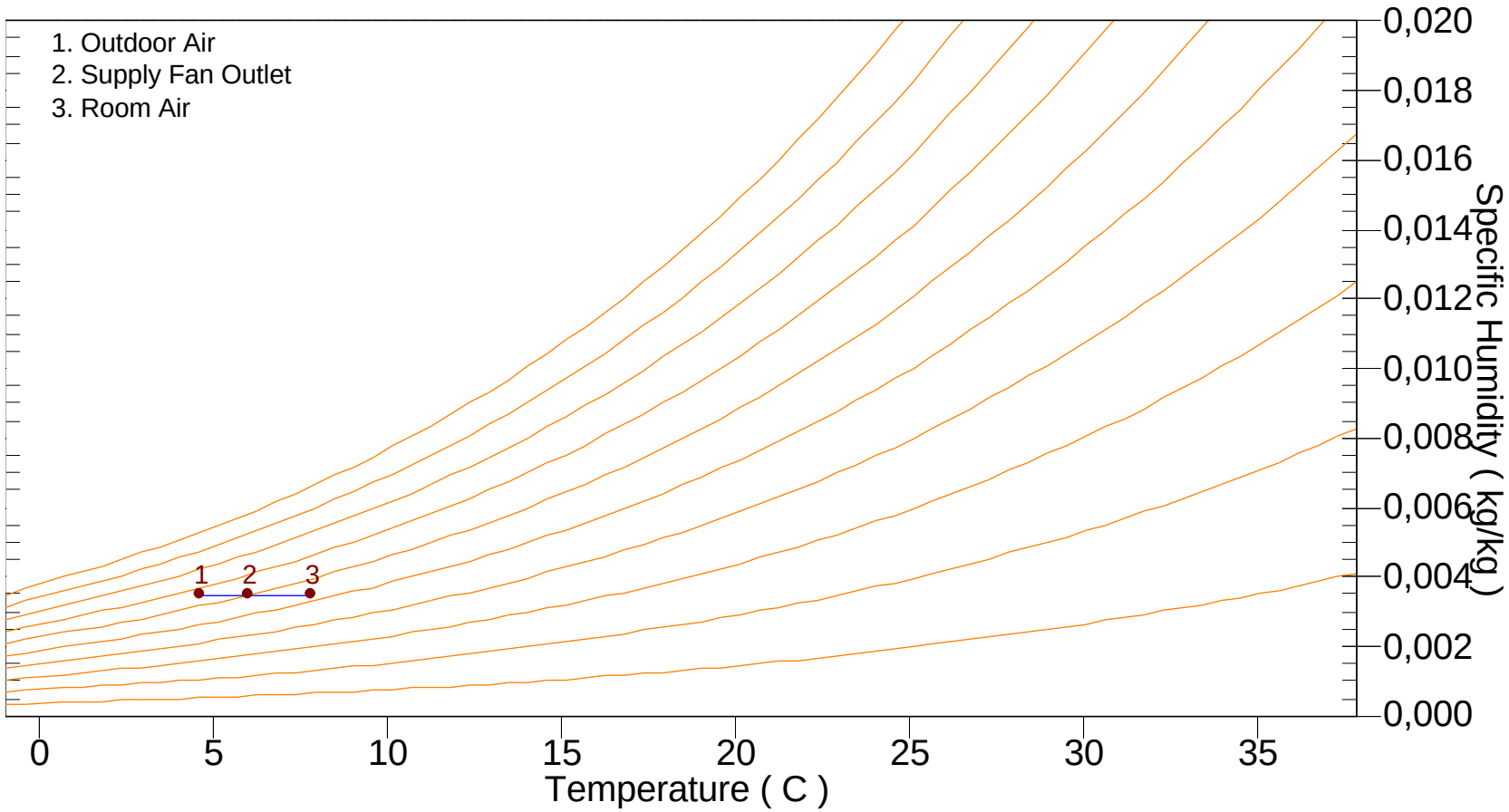
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
0.3 Battery Room	0	Deadband	5493	7,7	2486	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: julho 11:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name	**HVAC - Control Building - AHU 1.1 (Offices 1)**	Number of zones	**18**
Equipment Class	**SPLT AHU**	Floor Area	**1173,4** sqm
Air System Type	**VAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**193,7**	kW	Peak coil load occurs at	**agosto 15:00**	
Sensible coil load	**139,9**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**4167**	L/s	Entering DB / WB	**41,3 / 25,3**	C
Sum of peak zone L/s	**4327**	L/s	Leaving DB / WB	**13,8 / 13,6**	C
Sensible heat ratio	**0,722**		Resulting RH	**55**	%
L/(s kW)	**21,5**		Design supply temp.	**16,0**	C
sqm/kW	**6,1**		Zone T-stat Check	**18 of 18**	OK
W/sqm	**165,1**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**29,7**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**3299**	L/s	Ent. DB / Lvg DB	**7,4 / 15,0**	C
Max coil L/s	**4242**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 0:00	**54,17**	kg/hr	Air mass flow	**11319,51**	kg/hr
Airflow Rate	**2659**	L/s	Moisture gain	**,00479**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**15,9**	kW	Load occurs at	**outubro 7:00**	
Coil L/s at outubro 7:00	**3610**	L/s	W/sqm	**13,5**	
Max coil L/s	**4242**	L/s	Ent. DB / Lvg DB	**14,7 / 18,3**	C
Water flow @ 11,1 K drop	**N/A**				

Supply Fan Sizing Data

Design L/s	**4242**	L/s	Fan motor BHP	**8,91**	BHP
Design L/s occurs at	**julho 16:00**		Fan motor kW	**7,07**	kW
Design L/(s sqm)	**3,62**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**4327**	L/s			
VAV Fan Diversity	**2,0**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**2585**	L/s	L/s/person	**63,05**	L/s/person
L/(s sqm)	**2,20**	L/(s sqm)			

Zone Sizing Summary for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name **HVAC - Control Building - AHU 1.1 (Offices 1)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **18**
Floor Area **1173,4** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
1.1.01 Corridor (1)	361	361	2,45	8,2	-	0,0	-	0
1.1.02 Lobby (Control Room)	167	167	17,87	3,8	-	0,0	-	0
1.1.03 Toilets M	486	486	9,84	11,0	-	0,0	-	0
1.1.04 Prayer Room M	181	139	5,01	3,1	-	0,0	-	0
1.1.05 Meeting Room (1)	238	153	5,69	3,5	-	0,0	-	0
1.1.06 Office 2	77	28	4,24	0,6	-	0,0	-	0
1.1.07 Office 3	75	28	4,17	0,6	-	0,0	-	0
1.1.08 Office 4	75	28	4,20	0,6	-	0,0	-	0
1.1.09 Office 5	76	28	4,24	0,6	-	0,0	-	0
1.1.10 Kitchen / Tea Prep. (1)	186	83	10,19	1,9	-	0,0	-	0
1.1.11 Pantry (1)	153	153	8,54	3,5	-	0,0	-	0
1.1.12 Storage Room (1)	56	56	4,25	1,3	-	0,0	-	0
1.1.13 Control Room Filing	97	97	4,40	2,2	-	0,0	-	0
1.1.14 Control Room Training	128	42	3,99	0,9	-	0,0	-	0
1.1.15 Control Room	949	194	2,78	4,8	-	0,0	-	0
1.1.16 Engineering Room	389	167	3,80	3,8	-	0,0	-	0
1.1.17 HVAC Room (1)	464	167	2,06	0,0	-	0,0	-	0
1.1.18 Corridor (2)	169	167	3,85	3,8	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.1.01 Corridor (1)	2,7	agosto 19:00	2,6	147,3
1.1.02 Lobby (Control Room)	0,4	agosto 9:00	0,3	9,3
1.1.03 Toilets M	1,1	julho 16:00	0,8	49,4
1.1.04 Prayer Room M	1,7	julho 17:00	0,6	36,1
1.1.05 Meeting Room (1)	2,3	julho 16:00	0,7	41,9
1.1.06 Office 2	0,7	julho 16:00	0,3	18,1
1.1.07 Office 3	0,7	julho 16:00	0,3	18,1
1.1.08 Office 4	0,7	julho 16:00	0,3	17,9
1.1.09 Office 5	0,7	julho 16:00	0,3	18,0
1.1.10 Kitchen / Tea Prep. (1)	1,8	julho 16:00	0,3	18,2
1.1.11 Pantry (1)	0,5	julho 19:00	0,3	17,9
1.1.12 Storage Room (1)	0,3	julho 19:00	0,2	13,2
1.1.13 Control Room Filing	0,1	julho 19:00	0,3	22,1
1.1.14 Control Room Training	1,2	julho 19:00	0,5	32,1
1.1.15 Control Room	9,0	setembro 12:00	3,5	341,7
1.1.16 Engineering Room	3,7	agosto 15:00	1,6	102,2
1.1.17 HVAC Room (1)	5,2	julho 19:00	0,0	225,9
1.1.18 Corridor (2)	1,9	agosto 17:00	1,8	43,9

Zone Sizing Summary for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.1.01 Corridor (1)						
1.1.01 Corridor (1)	2,7	agosto 19:00	361	2,6	147,3	2,45
1.1.02 Lobby (Control Room)						
1.1.02 Lobby (Control Room)	0,4	agosto 9:00	167	0,3	9,3	17,87
1.1.03 Toilets M						
1.1.03 Toilets M	1,1	julho 16:00	486	0,8	49,4	9,84
1.1.04 Prayer Room M						
1.1.04 Prayer Room M	1,7	julho 17:00	181	0,6	36,1	5,01
1.1.05 Meeting Room (1)						
1.1.05 Meeting Room (1)	2,3	julho 16:00	238	0,7	41,9	5,69
1.1.06 Office 2						
1.1.06 Office 2	0,7	julho 16:00	77	0,3	18,1	4,24
1.1.07 Office 3						
1.1.07 Office 3	0,7	julho 16:00	75	0,3	18,1	4,17
1.1.08 Office 4						
1.1.08 Office 4	0,7	julho 16:00	75	0,3	17,9	4,20
1.1.09 Office 5						
1.1.09 Office 5	0,7	julho 16:00	76	0,3	18,0	4,24
1.1.10 Kitchen / Tea Prep. (1)						
1.1.10 Kitchen / Tea Prep. (1)	1,8	julho 16:00	186	0,3	18,2	10,19
1.1.11 Pantry (1)						
1.1.11 Pantry (1)	0,5	julho 19:00	153	0,3	17,9	8,54
1.1.12 Storage Room (1)						
1.1.12 Storage Room (1)	0,3	julho 19:00	56	0,2	13,2	4,25
1.1.13 Control Room Filing						
1.1.13 Control Room Filing	0,1	julho 19:00	97	0,3	22,1	4,40
1.1.14 Control Room Training						
1.1.14 Control Room Training	1,2	julho 19:00	128	0,5	32,1	3,99
1.1.15 Control Room						
1.1.15 Control Room	9,0	setembro 12:00	949	3,5	341,7	2,78
1.1.16 Engineering Room						
1.1.16 Engineering Room	3,7	agosto 15:00	389	1,6	102,2	3,80
1.1.17 HVAC Room (1)						
1.1.17 HVAC Room (1)	1,6	julho 19:00	140	0,0	72,3	1,93
1.1.17 HVAC Room (1)	3,6	julho 19:00	325	0,0	153,6	2,11
1.1.18 Corridor (2)						
1.1.18 Corridor (2)	1,9	agosto 17:00	169	1,8	43,9	3,85

Air System Heat Balance Summary for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	33873	2774	-	17590	6
Plenum Load	-	0	0	-	0	0
Return Fan Load	1582 L/s	0	-	755 L/s	0	-
Ventilation Load	2585 L/s	87346	43372	2585 L/s	49744	31247
Supply Fan Load	4167 L/s	6965	-	3299 L/s	-5578	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**128183**	**46146**	**-**	**61756**	**31254**
Central Cooling Coil	-	139932	53809	-	0	0
Preheat Coil	-	0	-	-	29654	-
Dehumidification Reheat Coil	-	-7667	-	-	0	-
Humidification	8,73 kg/hr	-343	-5512	45,14 kg/hr	1787	28318
Terminal Reheat Coils	-	-567	-	-	30000	-
>> Total Conditioning	**-**	**131356**	**48297**	**-**	**61441**	**28318**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	620 sqm	4674	-	620 sqm	2250	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	22 sqm	935	-	22 sqm	524	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	20 sqm	483	-	20 sqm	190	-
Floor Convection	1173 sqm	5251	-	1173 sqm	2369	-
Interior Wall Convection	1289 sqm	3271	-	1289 sqm	2255	-
Ceiling Convection	1173 sqm	11067	-	1173 sqm	6050	-
Overhead Lighting Convection	5867 W	2482	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	2351 W	1763	-	0 W	0	-
People Convection	41	883	2463	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	3081	246	10%	1364	0
>> Total Zone Loads	**-**	**33889**	**2710**	**-**	**15001**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	2585	400	87346	43372
Vent - Return Mixing	Outlet	41,3	0,01406	4167	438	-	-
Preheat Coil	Outlet	41,3	0,01406	4167	438	0	-
Central Cooling Coil	Outlet	13,8	0,00975	4167	438	139932	53809
Supply Fan	Outlet	15,1	0,00975	4167	438	6965	-
Humidifier	Outlet	16,7	0,01024	4167	438	343	5512
Dehumid. Reheat Coil	Outlet	16,7	0,00975	4167	438	7667	-
Cold Supply Duct	Outlet	16,7	0,01024	4167	438	-	-
Zone Air	-	24,1	0,01043	1582	481	33873	2774
Zone Direct Exhaust	Outlet	23,1	0,01045	2585	487	-	-
Return Air	Outlet	24,2	0,01051	1582	500	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.1.01 Corridor (1)	0	Deadband	3173	24,0	361	438	0	0
1.1.02 Lobby (Control Room)	0	Deadband	773	21,0	167	438	91	0
1.1.03 Toilets M	0	Deadband	2087	21,0	486	438	428	0
1.1.04 Prayer Room M	1501	Cooling	1502	24,0	170	761	0	0
1.1.05 Meeting Room (1)	2059	Cooling	2060	24,0	233	673	0	0
1.1.06 Office 2	640	Cooling	641	24,0	73	514	0	0
1.1.07 Office 3	632	Cooling	633	24,0	72	515	0	0
1.1.08 Office 4	630	Cooling	631	24,0	72	515	0	0
1.1.09 Office 5	640	Cooling	640	24,0	73	514	0	0
1.1.10 Kitchen / Tea Prep. (1)	1588	Cooling	1588	24,0	180	591	0	0
1.1.11 Pantry (1)	0	Deadband	744	21,0	153	438	48	0
1.1.12 Storage Room (1)	0	Deadband	403	22,7	56	438	0	0
1.1.13 Control Room Filing	0	Deadband	622	22,0	97	438	0	0
1.1.14 Control Room Training	1017	Cooling	1017	24,0	115	534	0	0
1.1.15 Control Room	7882	Cooling	7883	24,0	894	469	0	0
1.1.16 Engineering Room	3463	Cooling	3432	24,0	389	509	0	0
1.1.17 HVAC Room (1)	4306	Cooling	4306	25,4	410	438	0	0
1.1.18 Corridor (2)	1628	Cooling	1741	25,3	167	438	0	0

System Psychrometrics for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

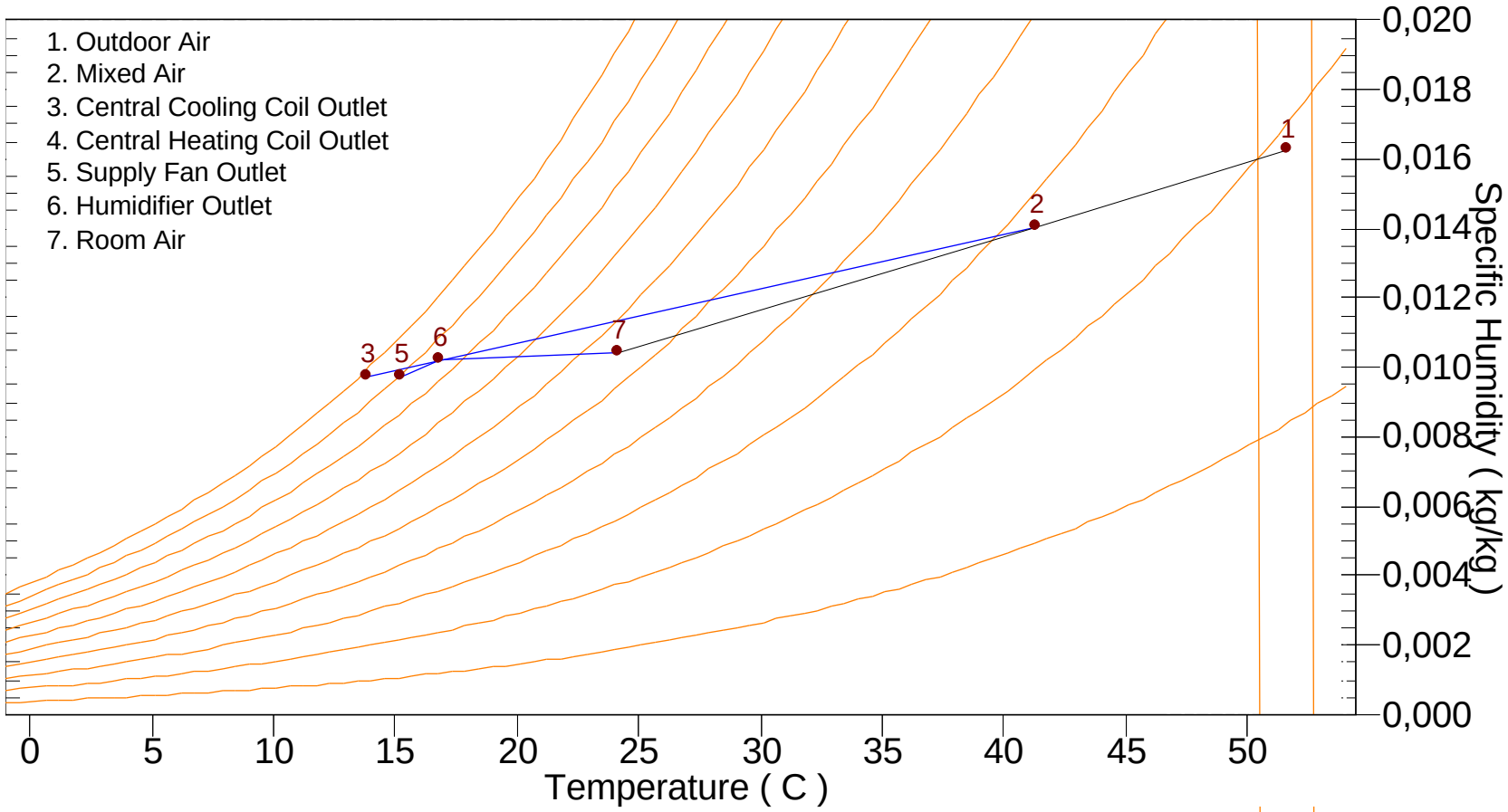
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2585	400	-49744	-31247
Vent - Return Mixing	Outlet	7,5	0,00432	3299	400	-	-
Preheat Coil	Outlet	15,0	0,00432	3299	400	29654	-
Central Cooling Coil	Outlet	15,0	0,00432	3299	400	0	0
Supply Fan	Outlet	16,4	0,00432	3299	400	5578	-
Humidifier	Outlet	16,9	0,00753	3299	400	1787	28318
Dehumid. Reheat Coil	Outlet	16,4	0,00432	3299	400	0	-
Cold Supply Duct	Outlet	16,9	0,00753	3299	400	-	-
Zone Air	-	19,2	0,00753	755	400	-17590	-6
Zone Direct Exhaust	Outlet	20,5	0,00753	2585	400	-	-
Return Air	Outlet	18,3	0,00753	755	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

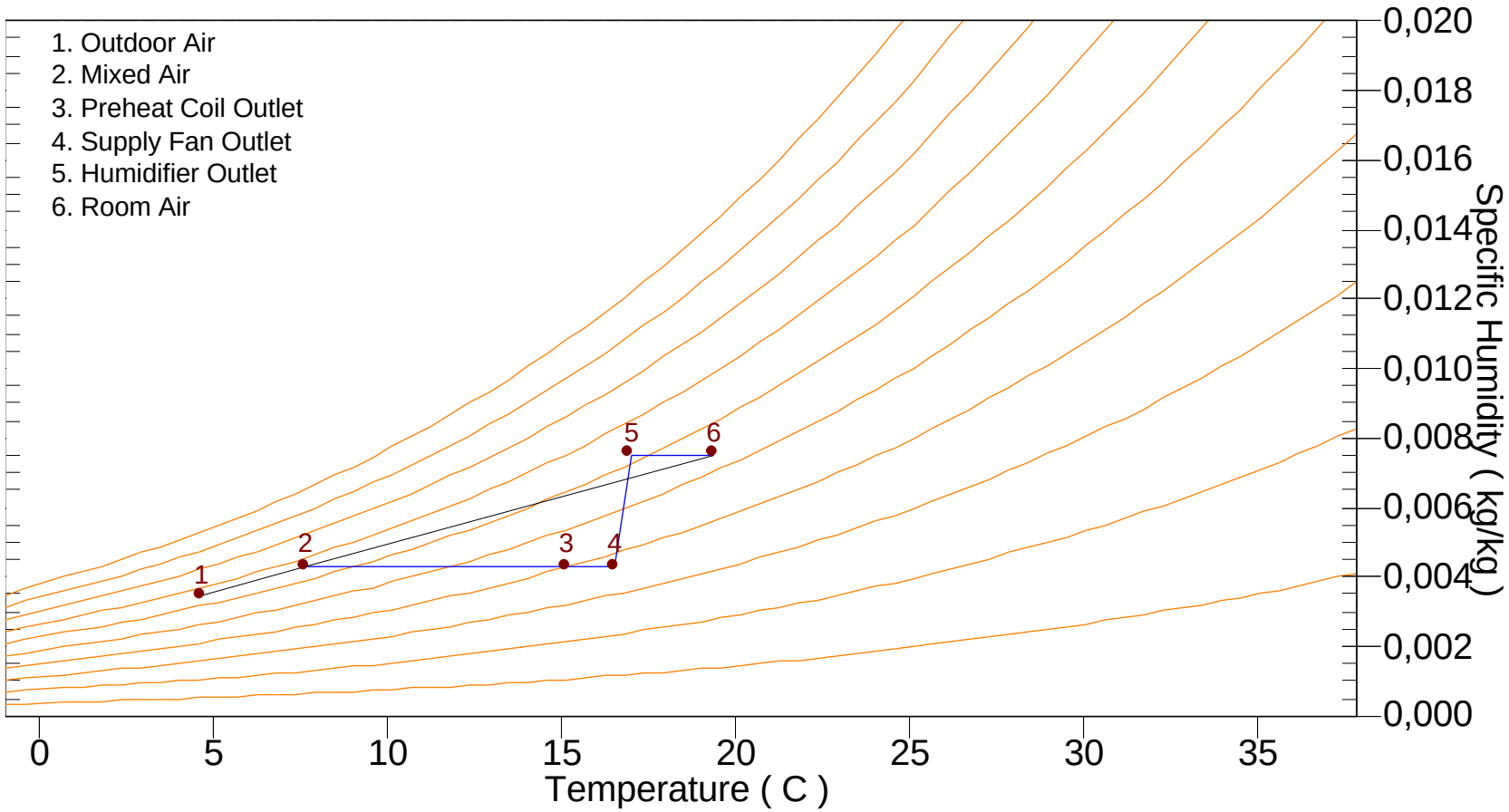
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.1.01 Corridor (1)	-3223	Heating	-3223	21,0	361	400	5026	0
1.1.02 Lobby (Control Room)	-457	Heating	-457	21,0	167	400	1291	0
1.1.03 Toilets M	-1107	Heating	-1107	21,0	486	400	3534	0
1.1.04 Prayer Room M	-734	Heating	-734	21,0	139	400	1428	0
1.1.05 Meeting Room (1)	-903	Heating	-903	21,0	153	400	1668	0
1.1.06 Office 2	-357	Heating	-357	21,0	28	400	496	0
1.1.07 Office 3	-360	Heating	-360	21,0	28	400	500	0
1.1.08 Office 4	-360	Heating	-360	21,0	28	400	500	0
1.1.09 Office 5	-356	Heating	-356	21,0	28	400	496	0
1.1.10 Kitchen / Tea Prep. (1)	-405	Heating	-405	21,0	83	400	820	0
1.1.11 Pantry (1)	-355	Heating	-355	21,0	153	400	1119	0
1.1.12 Storage Room (1)	-286	Heating	-286	21,0	56	400	566	0
1.1.13 Control Room Filing	-554	Heating	-554	21,0	97	400	1039	0
1.1.14 Control Room Training	-716	Heating	-715	21,0	42	400	927	0
1.1.15 Control Room	-27995	Heating	-3101	18,3	949	400	4794	0
1.1.16 Engineering Room	-2344	Heating	-2344	21,0	167	400	3178	0
1.1.17 HVAC Room (1)	0	Deadband	-189	15,9	167	400	0	0
1.1.18 Corridor (2)	-1784	Heating	-1784	21,0	167	400	2618	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Air System Sizing Summary for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name	**HVAC - Control Building - AHU 1.2 (Tech)**	Number of zones	**7**
Equipment Class	**SPLT AHU**	Floor Area	**656,0** sqm
Air System Type	**VAV**	Location	**Middle East**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**111,2**	kW	Peak coil load occurs at	**agosto 15:00**	
Sensible coil load	**96,3**	kW	OA DB / WB	**51,7 / 28,9**	C
Coil L/s at peak load	**5270**	L/s	Entering DB / WB	**30,0 / 20,5**	C
Sum of peak zone L/s	**5371**	L/s	Leaving DB / WB	**14,9 / 14,7**	C
Sensible heat ratio	**0,865**		Resulting RH	**51**	%
L/(s kW)	**47,4**		Design supply temp.	**16,0**	C
sqm/kW	**5,9**		Zone T-stat Check	**7 of 7**	OK
W/sqm	**169,6**		Max zone temperature deviation	**0,0**	K
Water flow @ 5,6 K rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**11,0**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**877**	L/s	Ent. DB / Lvg DB	**4,4 / 15,0**	C
Max coil L/s	**5347**	L/s			
Water flow @ 11,1 K drop	**N/A**				

Humidifier Sizing Data

Max steam flow at janeiro 5:00	**24,26**	kg/hr	Air mass flow	**20122,13**	kg/hr
Airflow Rate	**4726**	L/s	Moisture gain	**,00121**	kg/kg

Dehumidification Reheat Coil Sizing Data

No dehumidification reheat coil loads occurred during this calculation.

Supply Fan Sizing Data

Design L/s	**5347**	L/s	Fan motor BHP	**11,23**	BHP
Design L/s occurs at	**agosto 17:00**		Fan motor kW	**8,91**	kW
Design L/(s sqm)	**8,15**	L/(s sqm)	Fan total static	**1000**	Pa
Sum of peak zone L/s	**5371**	L/s			
VAV Fan Diversity	**0,5**	%			

Outdoor Ventilation Air Data

Design airflow L/s	**877**	L/s	L/s/person	**0,00**	L/s/person
L/(s sqm)	**1,34**	L/(s sqm)			

Zone Sizing Summary for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Air System Information

Air System Name **HVAC - Control Building - AHU 1.2 (Tech)**
Equipment Class **SPLT AHU**
Air System Type **VAV**
Number of zones **7**
Floor Area **656,0** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Peak zone sensible load**
Space L/s Sizing **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (L/s)	Minimum Supply Airflow (L/s)	Zone L/(s sqm)	Reheat Coil Capacity (kW)	Reheat Coil Water L/s @ 11,1 K	Zone Htg Unit Coil Capacity (kW)	Zone Htg Unit Water L/s @ 11,1 K	Mixing Box Fan Airflow (L/s)
1.2.01 Marshaling Room	643	167	3,63	0,0	-	0,0	-	0
1.2.02 Auxiliary Room	561	167	3,70	0,0	-	0,0	-	0
1.2.03 Server Room	952	167	18,69	0,0	-	0,0	-	0
1.2.04 UPS Room	2298	167	17,97	0,0	-	0,0	-	0
1.2.05 Security Equipment Room	455	14	18,93	0,0	-	0,0	-	0
1.2.07 Machine Room	142	28	3,95	0,0	-	0,0	-	0
1.2.08 Water Tanks	319	167	3,62	0,0	-	0,0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.2.01 Marshaling Room	7,3	agosto 17:00	0,0	177,2
1.2.02 Auxiliary Room	6,4	setembro 13:00	0,0	151,8
1.2.03 Server Room	10,9	setembro 13:00	0,0	51,0
1.2.04 UPS Room	26,2	setembro 13:00	0,0	127,9
1.2.05 Security Equipment Room	5,2	julho 21:00	0,0	24,1
1.2.07 Machine Room	1,6	julho 20:00	0,0	35,9
1.2.08 Water Tanks	3,6	julho 20:00	0,0	88,2

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.2.01 Marshaling Room						
1.2.01 Marshaling Room	7,3	agosto 17:00	643	0,0	177,2	3,63
1.2.02 Auxiliary Room						
1.2.02 Auxiliary Room	6,4	setembro 13:00	561	0,0	151,8	3,70
1.2.03 Server Room						
1.2.03 Server Room	10,9	setembro 13:00	952	0,0	51,0	18,69
1.2.04 UPS Room						
1.2.04 UPS Room	26,2	setembro 13:00	2298	0,0	127,9	17,97
1.2.05 Security Equipment Room						
1.2.05 Security Equipment Room	5,2	julho 21:00	455	0,0	24,1	18,93
1.2.07 Machine Room						
1.2.07 Machine Room	1,6	julho 20:00	142	0,0	35,9	3,95
1.2.08 Water Tanks						
1.2.08 Water Tanks	3,6	julho 20:00	319	0,0	88,2	3,62

Air System Heat Balance Summary for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

Table 1. System Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	59396	2	-	1108	0
Plenum Load	-	0	0	-	0	0
Return Fan Load	4393 L/s	0	-	0 L/s	0	-
Ventilation Load	877 L/s	27064	14505	877 L/s	13037	7634
Supply Fan Load	5270 L/s	8806	-	877 L/s	-2773	-
Zone Fan Coil Fans Load	-	0	-	-	0	-
>> Total System Loads	**-**	**95266**	**14507**	**-**	**11372**	**7634**
Central Cooling Coil	-	96261	14989	-	0	0
Preheat Coil	-	0	-	-	11039	-
Dehumidification Reheat Coil	-	0	-	-	0	-
Humidification	0,00 kg/hr	0	0	11,20 kg/hr	437	7026
>> Total Conditioning	**-**	**96261**	**14989**	**-**	**11476**	**7026**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - AGOSTO 15:00			DESIGN HEATING		
	OA DB / WB 51,7 C / 28,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	240 sqm	2398	-	240 sqm	290	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	16 sqm	854	-	16 sqm	245	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	4 sqm	89	-	4 sqm	9	-
Floor Convection	656 sqm	3913	-	656 sqm	-233	-
Interior Wall Convection	592 sqm	3052	-	592 sqm	-324	-
Ceiling Convection	656 sqm	6391	-	656 sqm	16	-
Overhead Lighting Convection	3280 W	1387	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	49740 W	37305	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	5539	0	10%	0	0
>> Total Zone Loads	**-**	**60930**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN COOLING DAY AT AGOSTO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	51,6	0,01624	877	400	27064	14505
Vent - Return Mixing	Outlet	30,0	0,01148	5270	400	-	-
Preheat Coil	Outlet	30,0	0,01148	5270	400	0	-
Central Cooling Coil	Outlet	14,9	0,01054	5270	400	96261	14989
Supply Fan	Outlet	16,3	0,01054	5270	400	8806	-
Humidifier	Outlet	16,3	0,01054	5270	400	0	0
Dehumid. Reheat Coil	Outlet	16,3	0,01054	5270	400	0	-
Cold Supply Duct	Outlet	16,3	0,01054	5270	400	-	-
Zone Air	-	25,6	0,01054	4393	400	59396	2
Zone Direct Exhaust	Outlet	25,6	0,01054	877	400	-	-
Return Air	Outlet	25,6	0,01054	4393	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.2.01 Marshaling Room	6901	Cooling	6901	25,6	612	400	0	0
1.2.02 Auxiliary Room	5935	Cooling	5935	25,6	527	400	0	0
1.2.03 Server Room	10728	Cooling	10728	25,6	952	400	0	0
1.2.04 UPS Room	25899	Cooling	25899	25,6	2298	400	0	0
1.2.05 Security Equipment Room	5109	Cooling	5109	25,6	453	400	0	0
1.2.07 Machine Room	1474	Cooling	1474	25,6	131	400	0	0
1.2.08 Water Tanks	3350	Cooling	3350	25,6	297	400	0	0

System Psychrometrics for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:32

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

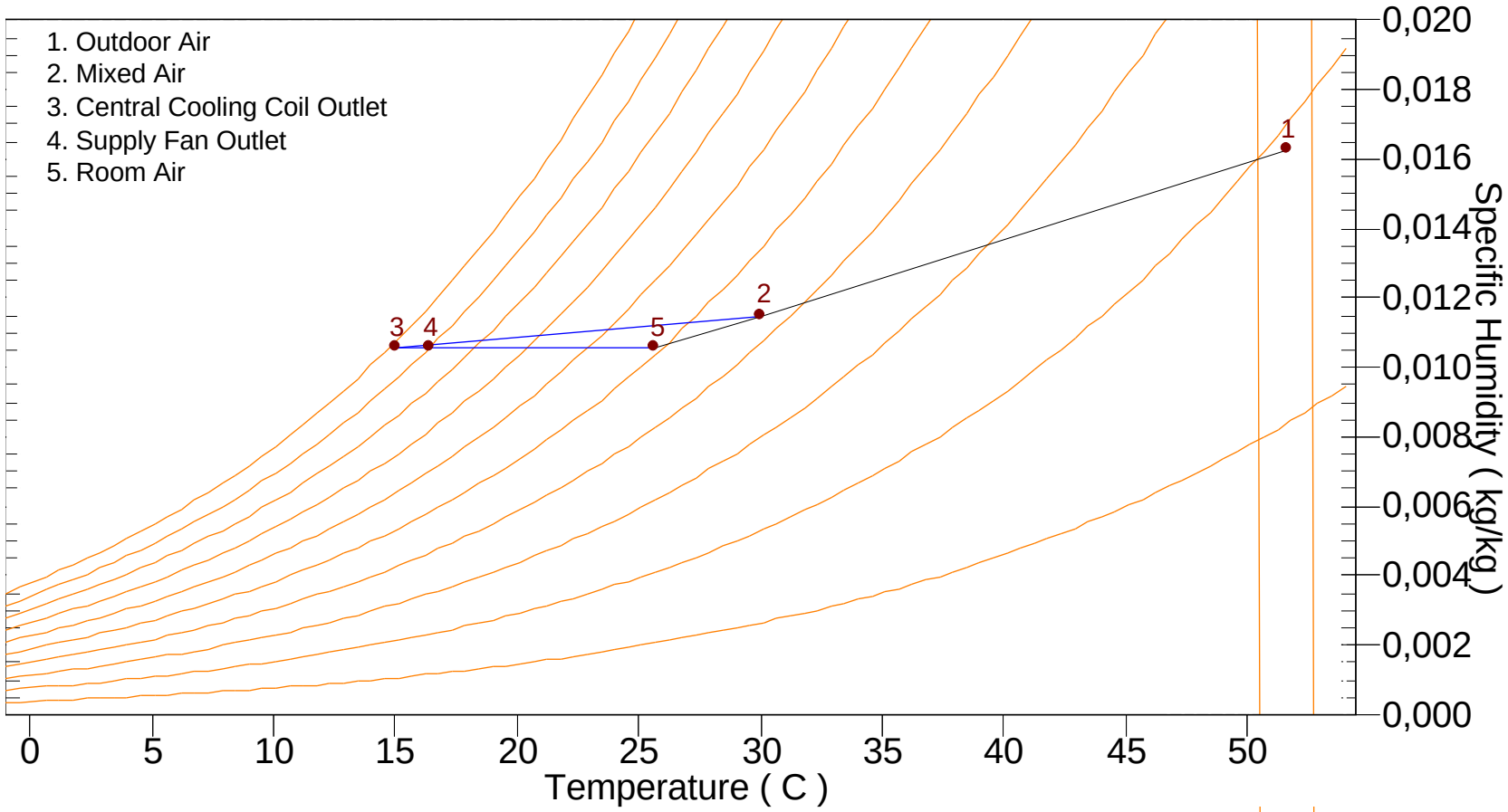
Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	877	400	-13037	-7634
Vent - Return Mixing	Outlet	4,5	0,00343	877	400	-	-
Preheat Coil	Outlet	15,0	0,00343	877	400	11039	-
Central Cooling Coil	Outlet	15,0	0,00343	877	400	0	0
Supply Fan	Outlet	17,6	0,00343	877	400	2773	-
Humidifier	Outlet	18,1	0,00643	877	400	437	7026
Dehumid. Reheat Coil	Outlet	17,6	0,00343	877	400	0	-
Cold Supply Duct	Outlet	18,1	0,00643	877	400	-	-
Zone Air	-	17,1	0,00643	0	400	-1108	0
Zone Direct Exhaust	Outlet	17,0	0,00643	877	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

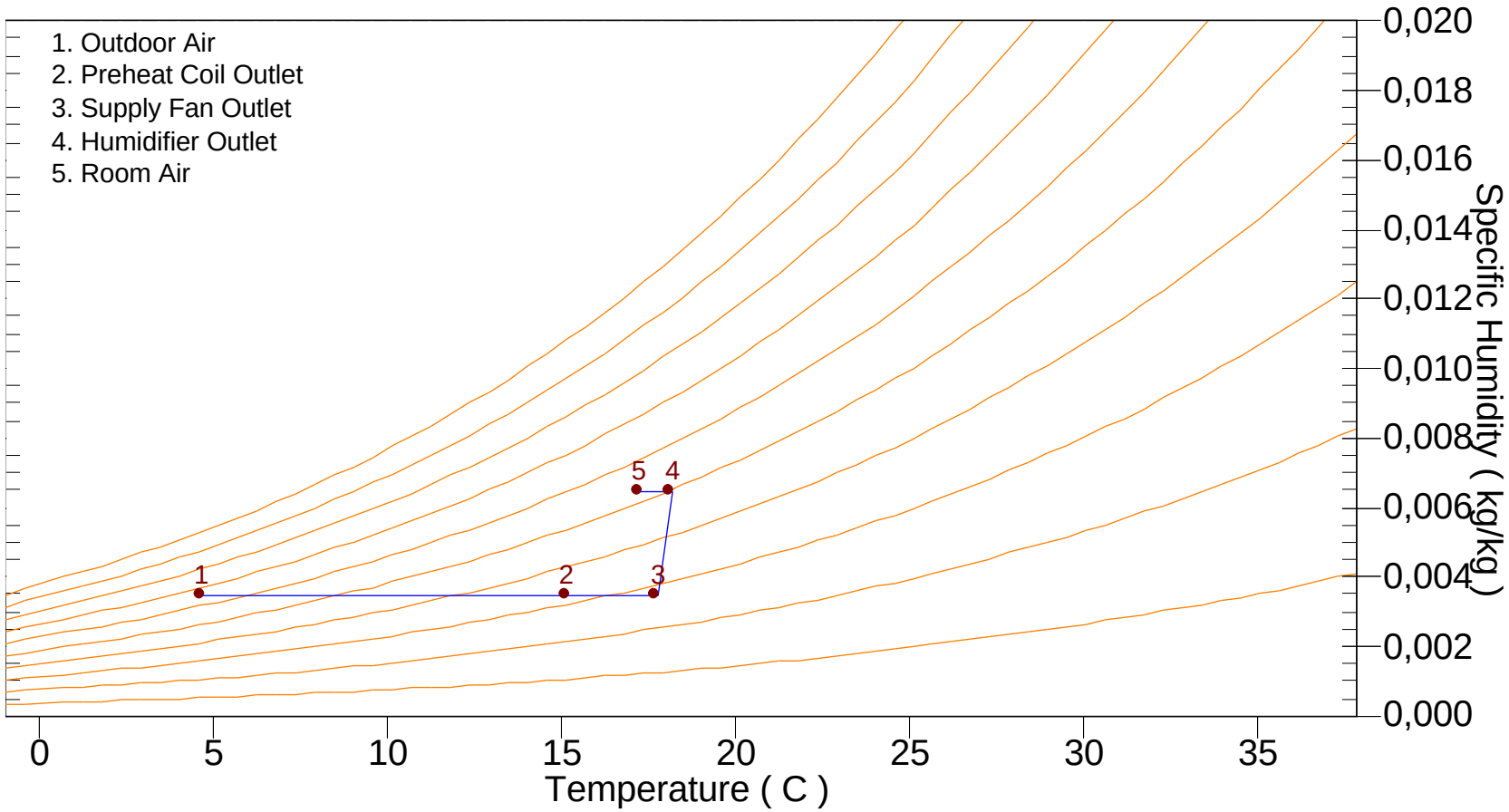
TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (W)	T-stat Mode	Zone Cond (W)	Zone Temp (C)	Zone Airflow (L/s)	CO2 Level (ppm)	Terminal Heating Coil (W)	Zone Heating Unit (W)
1.2.01 Marshaling Room	0	Deadband	-108	17,5	167	400	0	0
1.2.02 Auxiliary Room	0	Deadband	-35	17,9	167	400	0	0
1.2.03 Server Room	0	Deadband	-105	17,5	167	400	0	0
1.2.04 UPS Room	0	Deadband	-244	16,8	167	400	0	0
1.2.05 Security Equipment Room	0	Deadband	0	18,0	14	400	0	0
1.2.07 Machine Room	0	Deadband	-64	16,2	28	400	0	0
1.2.08 Water Tanks	0	Deadband	-553	15,3	167	400	0	0

Location: Middle East
Altitude: 132,0 m.
Data for: agosto 15:00



Location: Middle East
Altitude: 132,0 m.
Data for: Design Heating



Annual Cost Summary

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Table 1. Annual Costs

Component	HVAC - Control Building (€)
Air System Fans	17 178
Cooling	45 177
Heating	72 924
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**135 279**
Lights	5 815
Electric Equipment	37 144
Misc. Electric	5 046
Misc. Fuel Use	0
Non-HVAC Sub-Total	**48 005**
Grand Total	**183 283**

Table 2. Annual Cost per Unit Floor Area

Component	HVAC - Control Building (€/sqm)
Air System Fans	5,773
Cooling	15,183
Heating	24,509
Pumps	0,000
Heat Rejection Fans	0,000
HVAC Sub-Total	**45,466**
Lights	1,954
Electric Equipment	12,484
Misc. Electric	1,696
Misc. Fuel Use	0,000
Non-HVAC Sub-Total	**16,134**
Grand Total	**61,599**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	HVAC - Control Building (%)
Air System Fans	9,4
Cooling	24,6
Heating	39,8
Pumps	0,0
Heat Rejection Fans	0,0
HVAC Sub-Total	**73,8**
Lights	3,2
Electric Equipment	20,3
Misc. Electric	2,8
Misc. Fuel Use	0,0
Non-HVAC Sub-Total	**26,2**
Grand Total	**100,0**

Table 1. Annual Costs

Component	HVAC - Control Building (€)
HVAC Components	
Electric	135 277
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**135 277**
Non-HVAC Components	
Electric	48 005
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**48 005**
Grand Total	**183 281**

Table 2. Annual Energy Consumption

Component	HVAC - Control Building
HVAC Components	
Electric (kWh)	1 878 843
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	666 732
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	2 545 575
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	HVAC - Control Building
CO2 Equivalent (kg)	916 423

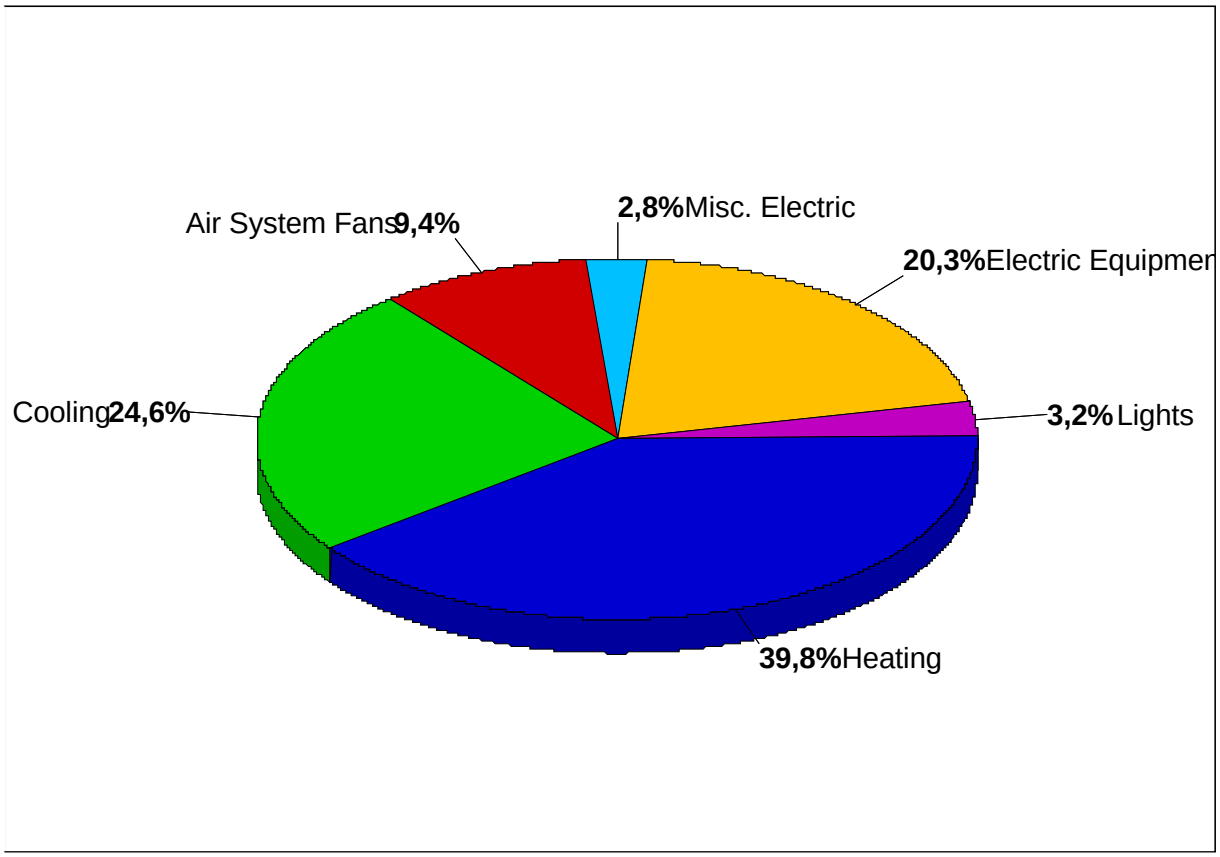
Table 4. Annual Cost per Unit Floor Area

Component	HVAC - Control Building (€/sqm)
HVAC Components	
Electric	45,465
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Remote CW	0,000
HVAC Sub-Total	**45,465**
Non-HVAC Components	
Electric	16,134
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Non-HVAC Sub-Total	**16,134**
Grand Total	**61,599**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	HVAC - Control Building (%)
HVAC Components	
Electric	73,8
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Remote CW	0,0
HVAC Sub-Total	**73,8**
Non-HVAC Components	
Electric	26,2
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Non-HVAC Sub-Total	**26,2**
Grand Total	**100,0**

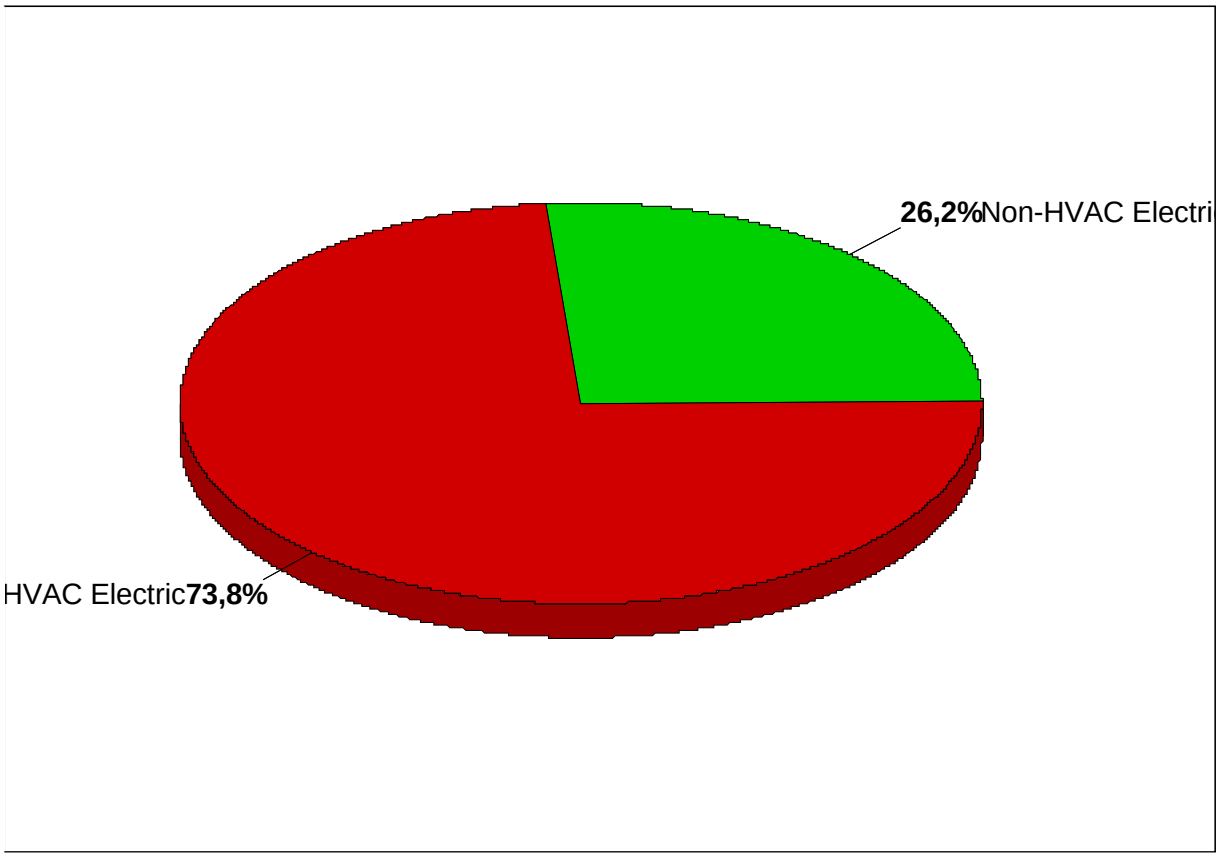


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	17 178	5,773	9,4
Cooling	45 177	15,183	24,6
Heating	72 924	24,509	39,8
Pumps	0	0,000	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**135 279**	**45,466**	**73,8**
Lights	5 815	1,954	3,2
Electric Equipment	37 144	12,484	20,3
Misc. Electric	5 046	1,696	2,8
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**26,2**
Grand Total	**183 283**	**61,599**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

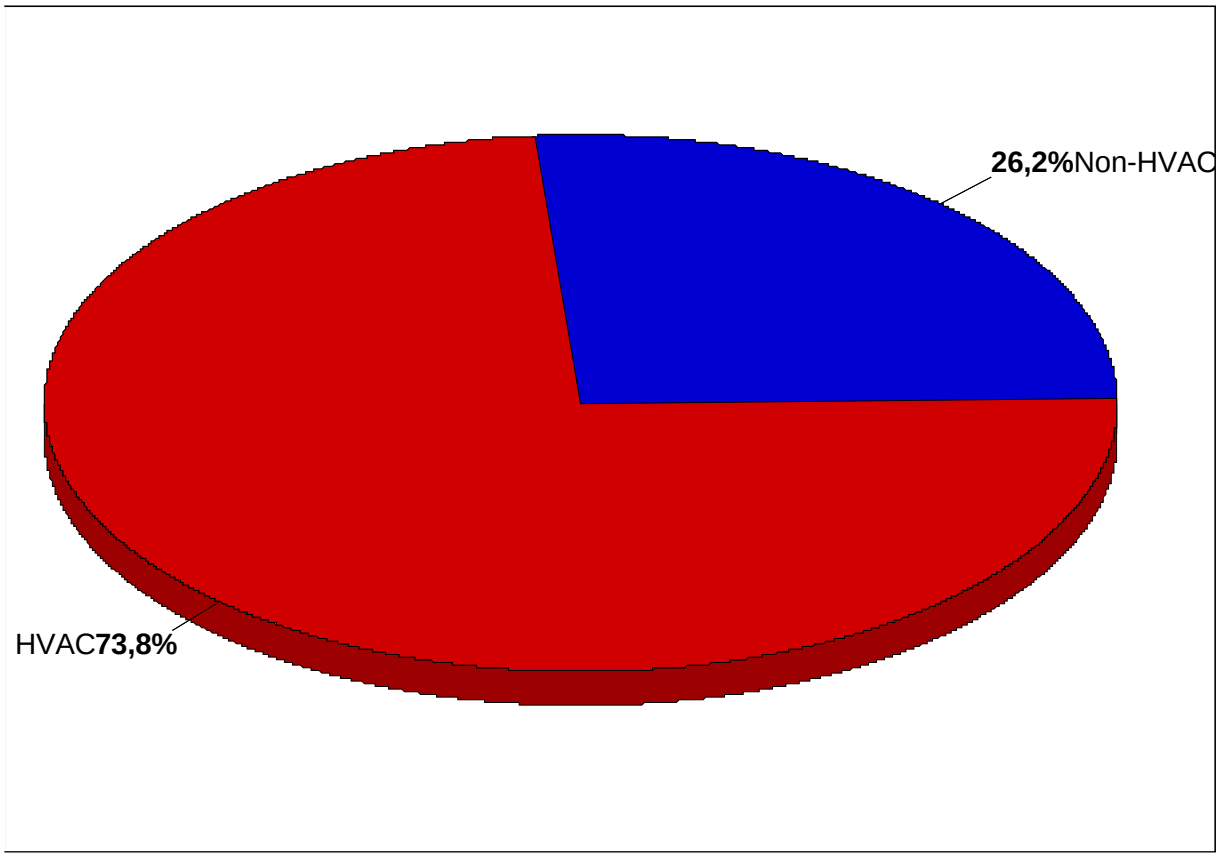


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC Components			
Electric	135 277	45,465	73,8
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Remote Chilled Water	0	0,000	0,0
HVAC Sub-Total	**135 277**	**45,465**	**73,8**
Non-HVAC Components			
Electric	48 005	16,134	26,2
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Non-HVAC Sub-Total	**48 005**	**16,134**	**26,2**
Grand Total	**183 281**	**61,599**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm



1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC	135 279	45,466	73,8
Non-HVAC	48 005	16,134	26,2
Grand Total	**183 283**	**61,600**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

Energy Budget by System Component - HVAC - Control Building

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 783 123	599,287
Heating Coil Loads	961 669	323,206
Grand Total	**2 744 791**	**922,493**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	238 587	80,186	596 467	200,466
Cooling	627 452	210,879	1 568 629	527,199
Heating	1 012 822	340,398	2 532 056	850,995
Pumps	0	0,000	0	0,000
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 878 861**	**631,464**	**4 697 152**	**1578,660**
Lights	80 763	27,143	201 907	67,859
Electric Equipment	515 885	173,383	1 289 712	433,457
Misc. Electric	70 078	23,553	175 196	58,881
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 726**	**224,079**	**1 666 814**	**560,197**
Grand Total	**2 545 586**	**855,543**	**6 363 966**	**2138,857**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 783 123	599,287
Heating Coil Loads	961 669	323,206
Grand Total	**2 744 791**	**922,493**

2. Energy Consumption by Energy Source

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
HVAC Components				
Electric	1 878 832	631,454	4 697 081	1578,636
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Remote Chilled Water	0	0,000	0	0,000
HVAC Sub-Total	**1 878 832**	**631,454**	**4 697 081**	**1578,636**
Non-HVAC Components				
Electric	666 728	224,080	1 666 820	560,199
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Non-HVAC Sub-Total	**666 728**	**224,080**	**1 666 820**	**560,199**
Grand Total	**2 545 560**	**855,534**	**6 363 901**	**2138,835**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

Monthly Component Costs - HVAC - Control Building

Project: Anexo I - Calculations 11-03-2025
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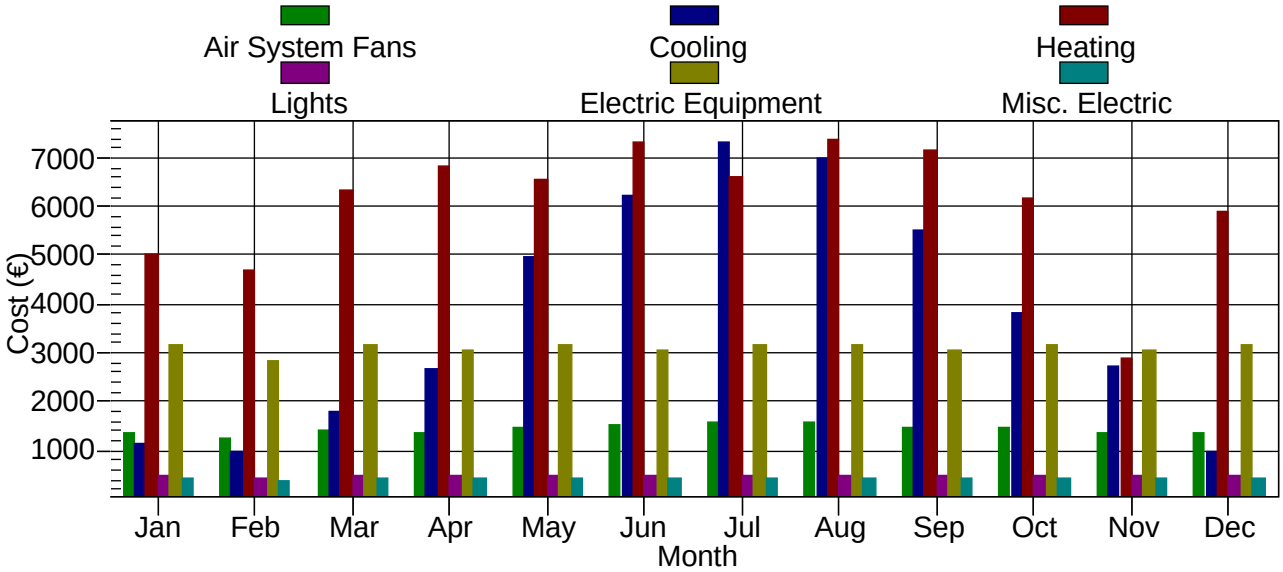
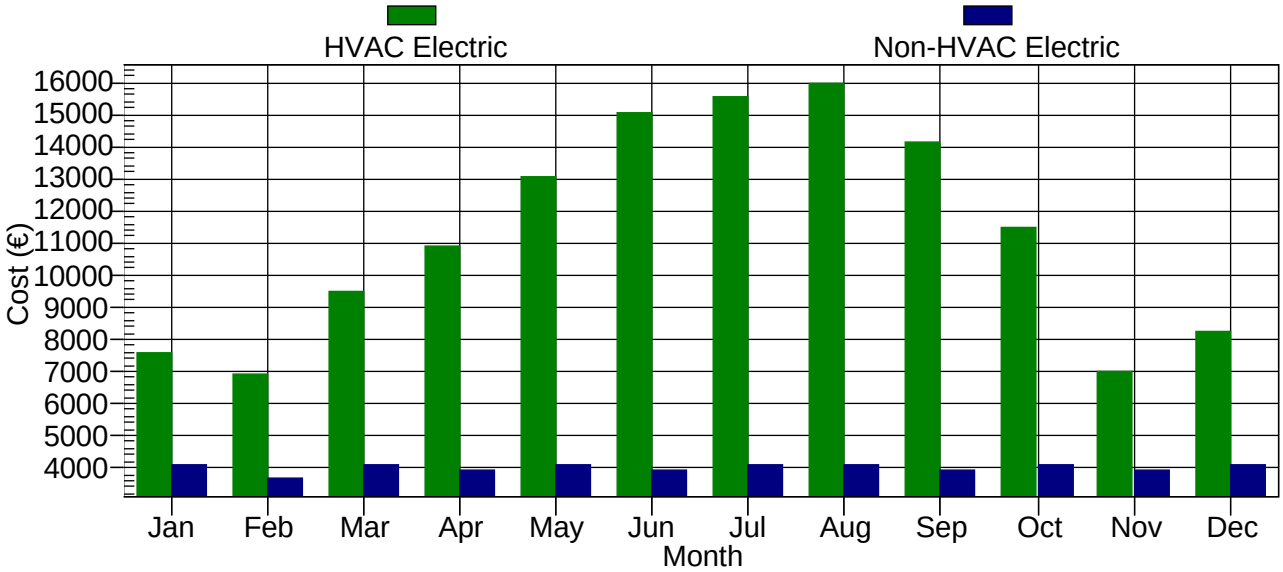


1. HVAC Component Costs

Month	Air System Fans (€)	Cooling (€)	Heating (€)	Pumps (€)	Heat Rejection Fans (€)	HVAC Total (€)
January	1 358	1 169	5 038	0	0	7 565
February	1 243	1 004	4 683	0	0	6 930
March	1 395	1 786	6 337	0	0	9 518
April	1 389	2 678	6 836	0	0	10 903
May	1 486	4 972	6 577	0	0	13 035
June	1 503	6 229	7 296	0	0	15 028
July	1 564	7 338	6 613	0	0	15 515
August	1 568	6 976	7 394	0	0	15 938
September	1 488	5 509	7 177	0	0	14 174
October	1 473	3 824	6 148	0	0	11 445
November	1 340	2 729	2 901	0	0	6 970
December	1 371	962	5 924	0	0	8 257
Total	**17 178**	**45 177**	**72 924**	**0**	**0**	**135 279**

2. Non-HVAC Component Costs

Month	Lights (€)	Electric Equipment (€)	Misc. Electric (€)	Misc. Fuel Use (€)	Non-HVAC Total (€)	Grand Total (€)
January	494	3 155	429	0	4 077	11 642
February	446	2 849	387	0	3 683	10 613
March	494	3 155	429	0	4 077	13 595
April	478	3 053	415	0	3 946	14 849
May	494	3 155	429	0	4 077	17 112
June	478	3 053	415	0	3 946	18 974
July	494	3 155	429	0	4 077	19 592
August	494	3 155	429	0	4 077	20 015
September	478	3 053	415	0	3 946	18 120
October	494	3 155	429	0	4 077	15 522
November	478	3 053	415	0	3 946	10 916
December	494	3 155	429	0	4 077	12 334
Total	**5 815**	**37 144**	**5 046**	**0**	**48 005**	**183 283**



1. HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)	Remote Chilled Water (€)
January	7 565	0	0	0	0	0	0
February	6 930	0	0	0	0	0	0
March	9 518	0	0	0	0	0	0
April	10 903	0	0	0	0	0	0
May	13 035	0	0	0	0	0	0
June	15 029	0	0	0	0	0	0
July	15 515	0	0	0	0	0	0
August	15 937	0	0	0	0	0	0
September	14 174	0	0	0	0	0	0
October	11 446	0	0	0	0	0	0
November	6 970	0	0	0	0	0	0
December	8 257	0	0	0	0	0	0
Total	**135 277**	**0**	**0**	**0**	**0**	**0**	**0**

2. Non-HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)
January	4 077	0	0	0	0	0
February	3 683	0	0	0	0	0
March	4 077	0	0	0	0	0
April	3 946	0	0	0	0	0
May	4 077	0	0	0	0	0
June	3 946	0	0	0	0	0
July	4 077	0	0	0	0	0
August	4 077	0	0	0	0	0
September	3 946	0	0	0	0	0
October	4 077	0	0	0	0	0
November	3 946	0	0	0	0	0
December	4 077	0	0	0	0	0
Total	**48 005**	**0**	**0**	**0**	**0**	**0**

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	18857	17260	19381	19289	20643	20881	21722	21782	20667	20461	18607	19038
Cooling												
Electric (kWh)	16243	13942	24800	37194	69053	86519	101917	96885	76515	53118	37908	13363
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	69971	65046	88009	94943	91351	101336	91847	102688	99685	85390	40291	82271
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	6859	6196	6859	6638	6859	6638	6859	6859	6638	6859	6638	6859
Electric Eqpt. (kWh)	43815	39575	43815	42402	43815	42402	43815	43815	42402	43815	42402	43815
Misc. Electric (kWh)	5952	5376	5952	5760	5952	5760	5952	5952	5760	5952	5760	5952
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Energy Use by Energy Type - HVAC - Control Building

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	105 072	0	0	0	0	0	0
Feb	96 249	0	0	0	0	0	0
Mar	132 191	0	0	0	0	0	0
Apr	151 425	0	0	0	0	0	0
May	181 043	0	0	0	0	0	0
Jun	208 729	0	0	0	0	0	0
Jul	215 479	0	0	0	0	0	0
Aug	221 348	0	0	0	0	0	0
Sep	196 860	0	0	0	0	0	0
Oct	158 966	0	0	0	0	0	0
Nov	96 806	0	0	0	0	0	0
Dec	114 676	0	0	0	0	0	0
Totals	1 878 843	0	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	56 626	0	0	0	0	0
Feb	51 147	0	0	0	0	0
Mar	56 626	0	0	0	0	0
Apr	54 800	0	0	0	0	0
May	56 626	0	0	0	0	0
Jun	54 800	0	0	0	0	0
Jul	56 626	0	0	0	0	0
Aug	56 626	0	0	0	0	0
Sep	54 800	0	0	0	0	0
Oct	56 626	0	0	0	0	0
Nov	54 800	0	0	0	0	0
Dec	56 626	0	0	0	0	0
Totals	666 732	0	0	0	0	0

1. Component Charges

Billing Period	Energy Charges (€)	Demand Charges (€)	Customer Charges (€)	Taxes (€)	Total Charge (€)
Jan	11 642	0	0	0	11 642
Feb	10 612	0	0	0	10 612
Mar	13 595	0	0	0	13 595
Apr	14 848	0	0	0	14 848
May	17 113	0	0	0	17 113
Jun	18 975	0	0	0	18 975
Jul	19 592	0	0	0	19 592
Aug	20 015	0	0	0	20 015
Sep	18 120	0	0	0	18 120
Oct	15 523	0	0	0	15 523
Nov	10 916	0	0	0	10 916
Dec	12 334	0	0	0	12 334
Totals	183 285	0	0	0	183 285

2. Totals

Billing Period	Total Charges (€)	Total Consumption (kWh)	Avg Price (€/kWh)
Jan	11 642	161 697	0,0720
Feb	10 612	147 394	0,0720
Mar	13 595	188 819	0,0720
Apr	14 848	206 229	0,0720
May	17 113	237 675	0,0720
Jun	18 975	263 538	0,0720
Jul	19 592	272 113	0,0720
Aug	20 015	277 983	0,0720
Sep	18 120	251 668	0,0720
Oct	15 523	215 598	0,0720
Nov	10 916	151 606	0,0720
Dec	12 334	171 301	0,0720
Totals	183 285	2 545 620	0,0720

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	161 697
Feb	0	0	0	0	147 394
Mar	0	0	0	0	188 819
Apr	0	0	0	0	206 229
May	0	0	0	0	237 675
Jun	0	0	0	0	263 538
Jul	0	0	0	0	272 113
Aug	0	0	0	0	277 983
Sep	0	0	0	0	251 668
Oct	0	0	0	0	215 598
Nov	0	0	0	0	151 606
Dec	0	0	0	0	171 301
Totals	0	0	0	0	2 545 620

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	301,0
Feb	0,0	0,0	0,0	0,0	298,6
Mar	0,0	0,0	0,0	0,0	341,2
Apr	0,0	0,0	0,0	0,0	361,1
May	0,0	0,0	0,0	0,0	421,2
Jun	0,0	0,0	0,0	0,0	453,2
Jul	0,0	0,0	0,0	0,0	464,3
Aug	0,0	0,0	0,0	0,0	469,8
Sep	0,0	0,0	0,0	0,0	432,3
Oct	0,0	0,0	0,0	0,0	391,0
Nov	0,0	0,0	0,0	0,0	324,3
Dec	0,0	0,0	0,0	0,0	292,6

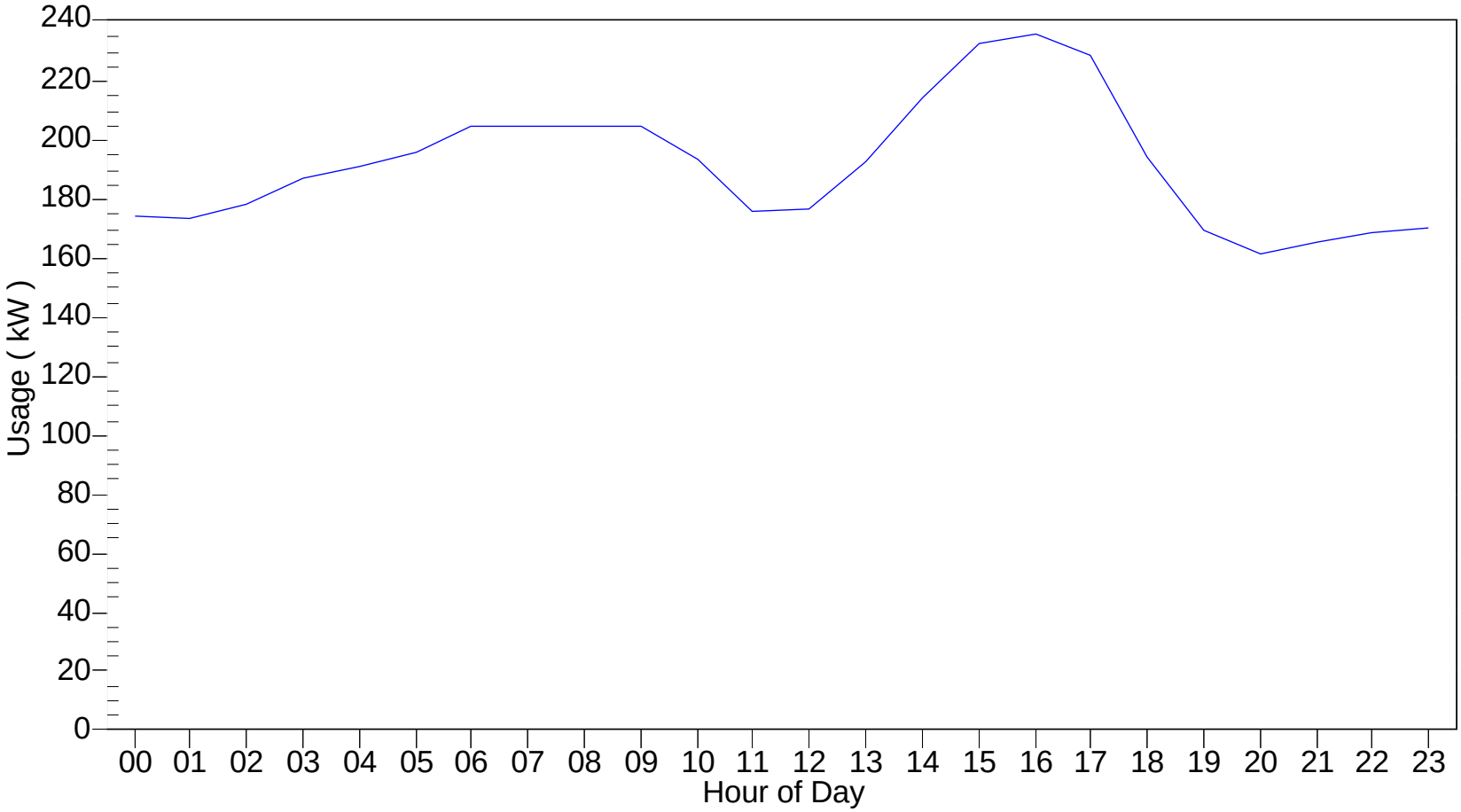
5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	301,0
Feb	0,0	0,0	0,0	0,0	298,6
Mar	0,0	0,0	0,0	0,0	341,2
Apr	0,0	0,0	0,0	0,0	361,1
May	0,0	0,0	0,0	0,0	421,2
Jun	0,0	0,0	0,0	0,0	453,2
Jul	0,0	0,0	0,0	0,0	464,3
Aug	0,0	0,0	0,0	0,0	469,8
Sep	0,0	0,0	0,0	0,0	432,3
Oct	0,0	0,0	0,0	0,0	391,0
Nov	0,0	0,0	0,0	0,0	324,3
Dec	0,0	0,0	0,0	0,0	292,6

6. Time Of Maximum Demands (Date/Hour)

Billing Period	Peak	Mid-Peak	Normal Peak	Off-Peak	Overall
Jan	n/a	n/a	n/a	n/a	1/13 07:00
Feb	n/a	n/a	n/a	n/a	2/10 15:00
Mar	n/a	n/a	n/a	n/a	3/15 14:00
Apr	n/a	n/a	n/a	n/a	4/17 15:00
May	n/a	n/a	n/a	n/a	5/29 15:00
Jun	n/a	n/a	n/a	n/a	6/18 16:00
Jul	n/a	n/a	n/a	n/a	7/16 16:00
Aug	n/a	n/a	n/a	n/a	8/4 16:00
Sep	n/a	n/a	n/a	n/a	9/5 15:00
Oct	n/a	n/a	n/a	n/a	10/6 15:00
Nov	n/a	n/a	n/a	n/a	11/8 13:00
Dec	n/a	n/a	n/a	n/a	12/11 04:00

Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)



Monthly Simulation Results for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	3059	3059	4474	1315	964	964	7024
February	571	571	4185	1373	62	62	3250
March	210	210	13052	4646	245	245	1346
April	0	0	22127	8270	20	20	308
May	0	0	41229	16651	527	527	204
June	0	0	46911	21423	0	0	178
July	0	0	58163	25499	351	351	277
August	0	0	52459	24151	0	0	253
September	0	0	43444	18794	0	0	166
October	0	0	33359	12488	237	237	244
November	21	21	18221	5554	3449	3449	2413
December	4278	4278	3094	962	432	432	5763
Total	**8139**	**8139**	**340717**	**141126**	**6287**	**6287**	**21426**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	7024	18022	12992	2866	1821	300
February	3250	20822	15010	2589	1644	271
March	1346	28232	20352	2867	1821	300
April	308	30720	22146	2807	1762	291
May	204	29904	21557	3052	1821	300
June	178	32556	23470	3137	1762	291
July	277	30755	22171	3277	1821	300
August	253	33561	24194	3294	1821	300
September	166	32465	23404	3104	1762	291
October	244	29244	21082	3004	1821	300
November	2413	7696	5548	2775	1762	291
December	5763	24204	17448	2866	1821	300
Total	**21426**	**318180**	**229373**	**35637**	**21437**	**3537**

Zone Temperature Report for HVAC - Control Building - AHU 0.1 (Offices 0)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.1.01 Corridor (0)	24,1	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.02 Lobby (North)	21,7	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.03 Lobby (West)	21,2	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.04 Corridor (SW)	23,9	0	0	26,4	8760	20,2	0	0	20,6	na	na	na	na
0.1.05 Corridor (SE)	23,9	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.06 Washroom (Senior Office)	21,3	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.07 Toilets M	21,1	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.08 Toilets F	21,1	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.09 Dinning Room	23,7	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.10 Kitchen / Tea Prep (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.11 Pantry (0)	21,3	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.12 Prayer Room F	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.13 Muster Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.14 Senior Office	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.15 Office 1	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.16 Meeting Room (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.17 Storage (East)	22,8	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.18 Storage (West)	22,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.19 Storage (Stairs)	22,5	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.20 Senior Store	23,1	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.21 HVAC Room (0)	25,6	0	0	26,4	8760	4,2	0	0	17,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	0	0	12206	2064	0	0	0
February	0	0	11825	2041	0	0	0
March	0	0	14165	2638	0	0	0
April	0	0	14905	3042	0	0	0
May	0	0	17280	4118	0	0	0
June	0	0	17213	4692	0	0	0
July	0	0	18798	5260	0	0	0
August	0	0	18391	5165	0	0	0
September	0	0	17178	4391	0	0	0
October	0	0	17069	3692	0	0	0
November	0	0	15045	2654	0	0	0
December	0	0	12446	2118	0	0	0
Total	**0**	**0**	**186522**	**41876**	**0**	**0**	**0**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	0	2139	1542	4145	364	5208
February	0	1934	1394	3741	329	4704
March	0	2141	1543	4154	364	5208
April	0	2072	1494	4028	353	5040
May	0	2079	1499	4157	364	5208
June	0	2072	1494	4020	353	5040
July	0	1907	1375	4147	364	5208
August	0	2132	1537	4145	364	5208
September	0	2072	1494	4007	353	5040
October	0	2087	1505	4132	364	5208
November	0	2015	1452	3964	353	5040
December	0	2141	1543	4090	364	5208
Total	**0**	**24790**	**17871**	**48730**	**4290**	**61320**

Zone Temperature Report for HVAC - Control Building - AHU 0.2 (Telecom)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:48

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.2.01 Telecom Room	20,0	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na
0.2.02 GSM Room	20,0	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Air System Simulation Results (Table 1) :

Month	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)
January	13552	3537	2	2	7101	5119	3083
February	3551	963	4	4	16200	11678	2784
March	3951	1322	0	0	34887	25150	3083
April	7584	2957	0	0	44026	31738	2983
May	26863	10388	0	0	39328	28351	3083
June	31393	14243	0	0	49475	35666	2983
July	42174	17858	0	0	40748	29375	3083
August	35312	16175	0	0	48776	35162	3083
September	26880	11688	0	0	47268	34075	2983
October	16016	6014	0	0	33869	24416	3083
November	47981	12319	356	356	3176	2290	2983
December	4170	1112	0	0	11250	8110	3083
Total	**259427**	**98576**	**362**	**362**	**376104**	**271130**	**36297**

Air System Simulation Results (Table 2) :

Month	Lighting (kWh)	Electric Equipment (kWh)
January	284	372
February	257	336
March	284	372
April	275	360
May	284	372
June	275	360
July	284	372
August	284	372
September	275	360
October	284	372
November	275	360
December	284	372
Total	**3344**	**4380**

Zone Temperature Report for HVAC - Control Building - AHU 0.3 (Battery)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:48

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.3 Battery Room	25,9	0	0	26,4	8760	4,2	0	0	5,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Terminal Heating Coil Load (kWh)
January	5777	5777	4449	1397	1134	1134	5442
February	1656	1656	4666	1614	72	72	2534
March	655	655	15578	5773	303	303	961
April	0	0	28292	10772	23	23	230
May	0	0	51899	21310	654	654	106
June	0	0	58954	27140	0	0	0
July	0	0	72068	32148	455	455	26
August	0	0	65868	30653	0	0	0
September	0	0	55187	24058	0	0	1
October	0	0	42526	16155	285	285	181
November	294	294	21497	6879	4260	4260	1949
December	7173	7173	3608	1182	603	603	5034
Total	**15555**	**15555**	**424594**	**179079**	**7789**	**7789**	**16465**

Air System Simulation Results (Table 2) :

Month	Terminal Heating Coil Input (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	5442	19372	13965	3264	3170	928
February	2534	23670	17064	2952	2863	839
March	961	33621	24237	3378	3170	928
April	230	36616	26396	3610	3068	898
May	106	35650	25699	4164	3170	928
June	0	38986	28104	4584	3068	898
July	26	36928	26621	4808	3170	928
August	0	40203	28982	4831	3170	928
September	1	38884	28031	4436	3068	898
October	181	34212	24663	4044	3170	928
November	1949	8049	5803	3220	3068	898
December	5034	26213	18897	3265	3170	928
Total	**16465**	**372403**	**268462**	**46557**	**37326**	**10931**

Zone Temperature Report for HVAC - Control Building - AHU 1.1 (Offices 1)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.1.01 Corridor (1)	24,2	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.02 Lobby (Control Room)	21,8	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.03 Toilets M	21,5	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.04 Prayer Room M	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.05 Meeting Room (1)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.06 Office 2	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.07 Office 3	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.08 Office 4	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.09 Office 5	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.10 Kitchen / Tea Prep. (1)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.11 Pantry (1)	21,7	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.12 Storage Room (1)	23,1	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.13 Control Room Filing	22,6	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na
1.1.14 Control Room Training	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.15 Control Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.16 Engineering Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
1.1.17 HVAC Room (1)	25,4	0	0	26,2	8760	4,2	0	0	19,1	na	na	na	na
1.1.18 Corridor (2)	25,3	0	0	26,2	8760	20,2	0	0	21,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:48

Air System Simulation Results (Table 1) :

Month	Preheat Coil Load (kWh)	Preheat Coil Input (kWh)	Central Cooling Coil Load (kWh)	Central Unit Clg Input (kWh)	Dehumid. Reheat Coil Load (kWh)	Dehumid. Reheat Input (kWh)	Humidifier Load (kg)
January	0	0	34729	7929	0	0	17967
February	0	0	34390	7951	0	0	16300
March	0	0	42106	10420	0	0	18047
April	0	0	45240	12154	0	0	17466
May	0	0	54372	16586	0	0	17693
June	0	0	54369	19021	0	0	17237
July	0	0	60016	21152	0	0	15532
August	0	0	58189	20741	0	0	17424
September	0	0	53753	17584	0	0	17362
October	0	0	53357	14769	0	0	17726
November	0	0	46357	10502	0	0	17278
December	0	0	34984	7988	0	0	18021
Total	**0**	**0**	**571863**	**166798**	**0**	**0**	**208052**

Air System Simulation Results (Table 2) :

Month	Humidifier Input (kWh)	Supply Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	12952	5498	1220	37007
February	11750	5194	1102	33425
March	13010	5900	1220	37007
April	12591	5861	1181	35813
May	12755	6187	1220	37007
June	12426	6156	1181	35813
July	11197	6407	1220	37007
August	12561	6429	1220	37007
September	12516	6136	1181	35813
October	12778	6199	1220	37007
November	12456	5665	1181	35813
December	12991	5734	1220	37007
Total	**149984**	**71366**	**14366**	**435723**

Zone Temperature Report for HVAC - Control Building - AHU 1.2 (Tech)

(In Alternative: HVAC - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:48

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.2.01 Marshaling Room	25,6	0	0	26,4	8760	4,2	0	0	25,5	na	na	na	na
1.2.02 Auxiliary Room	25,6	0	0	26,4	8760	4,2	0	0	25,5	na	na	na	na
1.2.03 Server Room	25,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.04 UPS Room	25,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.05 Security Equipment Room	25,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.07 Machine Room	25,6	0	0	26,4	8760	4,2	0	0	21,7	na	na	na	na
1.2.08 Water Tanks	25,6	0	0	26,4	8760	4,2	0	0	19,1	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

DOAS Sizing Summary for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name	**IPS - Control Building - FAHU 0.1 (Offices 0)**		Number of zones	**23**	
Equipment Class	**TERM**		Floor Area	**993,3**	sqm
Air System Type	**4P-FC**		Location	**Middle East**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**		Zone L/s Sizing	**Sum of space airflow rates**	
Sizing Data	**Calculated**		Space L/s Sizing	**Individual peak space loads**	

Cooling Coil Sizing Data

Total coil load	**123,2**	kW	Load occurs at	**agosto 14:00**	
Total coil load	**19,9**	L/(s kW)	OA DB / WB	**51,7 / 28,9**	C
Sensible coil load	**93,1**	kW	Entering DB / WB	**46,9 / 27,4**	C
Coil L/s at agosto 14:00	**2447**	L/s	Leaving DB / WB	**15,8 / 15,8**	C
Max coil L/s	**2447**	L/s			
Sensible heat ratio	**0,756**				
Water flow @ 6,0 K rise	**4,91**	L/s			

Heating Coil Sizing Data

Max coil load	**35,7**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**2447**	L/s	Ent. DB / Lvg DB	**7,3 / 19,6**	C
Max coil L/s	**2447**	L/s			
Water flow @ 5,0 K drop	**1,71**	L/s			

Humidifier Sizing Data

Max steam flow at janeiro 19:00	**42,20**	kg/hr	Air mass flow	**10418,76**	kg/hr
Airflow Rate	**2447**	L/s	Moisture gain	**,00405**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**11,5**	kW	Load occurs at	**agosto 4:00**	
Coil L/s at agosto 4:00	**2447**	L/s	W/sqm	**11,6**	
Max coil L/s	**2447**	L/s	Ent. DB / Lvg DB	**17,1 / 21,0**	C
Water flow @ 5,0 K drop	**0,55**	L/s			

Ventilation Fan Sizing Data

Design L/s	**2447**	L/s	Fan motor BHP	**5,14**	BHP
Design L/(s sqm)	**2,46**	L/(s sqm)	Fan motor kW	**4,08**	kW
			Fan total static	**1000**	Pa

Exhaust Fan Sizing Data

Actual max L/s	**2447**	L/s	Fan motor BHP	**2,57**	BHP
Standard L/s	**2409**	L/s	Fan motor kW	**2,04**	kW
Actual max L/(s sqm)	**2,46**	L/(s sqm)	Fan total static	**500**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**2447**	L/s	L/s/person	**50,98**	L/s/person
L/(s sqm)	**2,46**	L/(s sqm)			

Zone Sizing Summary for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name **IPS - Control Building - FAHU 0.1 (Offices 0)**
Equipment Class **TERM**
Air System Type **4P-FC**
Number of zones **23**
Floor Area **993,3** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (C)	Coil Leaving DB / WB (C)	Water Flow @ 6,0 K (L/s)	Time of Peak Coil Load	Zone L/(s sqm)
0.1.01 Corridor (0)	0,2	0,2	25,7 / 18,9	23,4 / 18,2	0,01	abril 19:00	0,43
0.1.02 Lobby (North)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	17,18
0.1.03 Lobby (West)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	22,20
0.1.04 Corridor (SW)	0,0	0,0	25,7 / 18,9	25,6 / 18,9	0,00	abril 14:00	4,09
0.1.05 Corridor (SE)	0,1	0,1	25,7 / 17,5	25,0 / 17,2	0,00	novembro 12:00	4,05
0.1.06 Washroom (Senior Office)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	8,74
0.1.07 Toilets M	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	10,04
0.1.08 Toilets F	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	9,25
0.1.09 Dinning Room	1,6	1,4	24,1 / 19,1	17,3 / 16,5	0,06	abril 14:00	5,08
0.1.10 Kitchen / Tea Prep (0)	1,9	1,5	24,1 / 18,0	14,9 / 13,8	0,08	abril 15:00	7,29
0.1.11 Pantry (0)	0,3	0,3	24,1 / 18,4	22,6 / 17,9	0,01	abril 19:00	8,49
0.1.12 Prayer Room F	1,2	0,9	24,1 / 18,6	15,8 / 14,9	0,05	abril 19:00	3,30
0.1.13 Muster Room	2,4	1,9	24,1 / 18,5	15,4 / 14,5	0,10	abril 15:00	2,74
0.1.14 Senior Office	1,0	0,8	24,1 / 18,2	15,9 / 14,7	0,04	abril 14:00	2,25
0.1.15 Office 1	0,5	0,4	24,1 / 18,2	15,8 / 14,7	0,02	abril 15:00	2,33
0.1.16 Meeting Room (0)	2,9	2,2	24,1 / 18,7	15,6 / 14,8	0,11	abril 15:00	4,08
0.1.17 Storage (East)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	4,25
0.1.18 Storage (West)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	3,88
0.1.19 Storage (Stairs)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	4,60
0.1.20 Senior Store	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	3,25
0.1.21 Telecom Room	13,8	12,7	20,4 / 15,2	14,6 / 12,8	0,55	abril 17:00	9,91
0.1.22 HVAC Room (0)	3,7	3,4	25,7 / 18,9	17,2 / 15,9	0,15	agosto 19:00	1,62
0.1.23 GSM Room	3,3	3,2	20,2 / 14,8	14,3 / 12,5	0,13	agosto 19:00	27,61

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (kW)	Heating Coil Ent/Lvg DB (C)	Htg Coil Water Flow @5,0 K (L/s)	Fan Design Airflow (L/s)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (L/s)
0.1.01 Corridor (0)	1,0	21,1 / 32,8	0,05	69	0,010	0,008	69
0.1.02 Lobby (North)	0,3	21,1 / 22,4	0,01	167	0,025	0,020	167
0.1.03 Lobby (West)	0,1	21,1 / 21,9	0,01	111	0,017	0,013	111
0.1.04 Corridor (SW)	1,3	21,1 / 31,2	0,06	111	0,017	0,013	111
0.1.05 Corridor (SE)	0,9	21,1 / 27,9	0,04	111	0,017	0,013	111
0.1.06 Washroom (Senior Office)	0,0	-17,8 / -17,8	0,00	56	0,008	0,007	56
0.1.07 Toilets M	0,1	21,1 / 21,5	0,00	181	0,027	0,022	181
0.1.08 Toilets F	0,1	21,1 / 21,6	0,00	167	0,025	0,020	167
0.1.09 Dinning Room	0,4	21,1 / 23,1	0,02	167	0,025	0,020	167
0.1.10 Kitchen / Tea Prep (0)	0,2	21,1 / 22,2	0,01	132	0,020	0,016	83
0.1.11 Pantry (0)	0,1	21,1 / 21,5	0,00	153	0,023	0,018	153
0.1.12 Prayer Room F	0,4	21,1 / 24,9	0,02	90	0,014	0,011	83
0.1.13 Muster Room	0,9	21,1 / 25,3	0,04	176	0,027	0,021	153
0.1.14 Senior Office	0,4	21,1 / 25,2	0,02	81	0,012	0,010	42
0.1.15 Office 1	0,2	21,1 / 25,1	0,01	42	0,006	0,005	28
0.1.16 Meeting Room (0)	0,5	21,1 / 23,0	0,02	208	0,031	0,025	208
0.1.17 Storage (East)	0,1	21,1 / 23,1	0,01	56	0,008	0,007	56
0.1.18 Storage (West)	0,1	21,1 / 22,6	0,01	69	0,010	0,008	69
0.1.19 Storage (Stairs)	0,1	21,1 / 23,1	0,00	42	0,006	0,005	42

Zone Name	Heating Coil Load (kW)	Heating Coil Ent/Lvg DB (C)	Htg Coil Water Flow @5,0 K (L/s)	Fan Design Airflow (L/s)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (L/s)
0.1.20 Senior Store	0,1	21,1 / 23,7	0,01	42	0,006	0,005	42
0.1.21 Telecom Room	0,0	-17,8 / -17,8	0,00	1780	0,269	0,214	167
0.1.22 HVAC Room (0)	0,0	-17,8 / -17,8	0,00	333	0,050	0,040	167
0.1.23 GSM Room	0,0	-17,8 / -17,8	0,00	447	0,068	0,054	14

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
0.1.01 Corridor (0)	0,3	agosto 19:00	1,1	162,3
0.1.02 Lobby (North)	0,1	julho 16:00	0,3	9,7
0.1.03 Lobby (West)	0,0	dezembro 22:00	0,2	5,0
0.1.04 Corridor (SW)	0,1	setembro 13:00	1,1	27,2
0.1.05 Corridor (SE)	0,2	setembro 12:00	0,7	27,4
0.1.06 Washroom (Senior Office)	0,0	janeiro 4:00	0,0	6,4
0.1.07 Toilets M	0,0	janeiro 3:00	0,2	18,0
0.1.08 Toilets F	0,0	dezembro 5:00	0,2	18,1
0.1.09 Dinning Room	1,5	julho 16:00	0,5	32,9
0.1.10 Kitchen / Tea Prep (0)	1,6	julho 16:00	0,2	18,1
0.1.11 Pantry (0)	0,2	julho 19:00	0,2	18,0
0.1.12 Prayer Room F	1,1	julho 17:00	0,5	27,2
0.1.13 Muster Room	2,1	julho 15:00	0,9	64,2
0.1.14 Senior Office	1,0	julho 16:00	0,4	36,1
0.1.15 Office 1	0,5	julho 16:00	0,2	18,1
0.1.16 Meeting Room (0)	2,3	julho 16:00	0,6	50,9
0.1.17 Storage (East)	0,0	julho 19:00	0,2	13,2
0.1.18 Storage (West)	0,0	janeiro 7:00	0,2	17,8
0.1.19 Storage (Stairs)	0,0	julho 19:00	0,1	9,1
0.1.20 Senior Store	0,0	julho 19:00	0,1	12,9
0.1.21 Telecom Room	12,7	setembro 18:00	0,0	179,7
0.1.22 HVAC Room (0)	4,6	agosto 19:00	0,0	204,8
0.1.23 GSM Room	3,2	agosto 17:00	0,0	16,2

Zone Sizing Summary for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
0.1.01 Corridor (0)						
0.1.01 Corridor (0)	0,3	agosto 19:00	59	0,9	152,3	0,39
0.1.01 Corridor (0)	0,0	agosto 19:00	10	0,1	10,0	1,00
0.1.02 Lobby (North)						
0.1.02 Lobby (North)	0,1	julho 16:00	167	0,3	9,7	17,18
0.1.03 Lobby (West)						
0.1.03 Lobby (West)	0,0	dezembro 22:00	111	0,2	5,0	22,20
0.1.04 Corridor (SW)						
0.1.04 Corridor (SW)	0,1	setembro 13:00	111	1,1	27,2	4,09
0.1.05 Corridor (SE)						
0.1.05 Corridor (SE)	0,2	setembro 12:00	111	0,7	27,4	4,05
0.1.06 Washroom (Senior Office)						
0.1.06 Washroom (Senior Office)	0,0	janeiro 4:00	56	0,0	6,4	8,74
0.1.07 Toilets M						
0.1.07 Toilets M	0,0	janeiro 3:00	181	0,2	18,0	10,04
0.1.08 Toilets F						
0.1.08 Toilets F	0,0	dezembro 5:00	167	0,2	18,1	9,25
0.1.09 Dinning Room						
0.1.09 Dinning Room	1,5	julho 16:00	167	0,5	32,9	5,08
0.1.10 Kitchen / Tea Prep (0)						
0.1.10 Kitchen / Tea Prep (0)	1,6	julho 16:00	132	0,2	18,1	7,29
0.1.11 Pantry (0)						
0.1.11 Pantry (0)	0,2	julho 19:00	153	0,2	18,0	8,49
0.1.12 Prayer Room F						
0.1.12 Prayer Room F	1,1	julho 17:00	90	0,5	27,2	3,30
0.1.13 Muster Room						
0.1.13 Muster Room	2,1	julho 15:00	176	0,9	64,2	2,74
0.1.14 Senior Office						
0.1.14 Senior Office	1,0	julho 16:00	81	0,4	36,1	2,25
0.1.15 Office 1						
0.1.15 Office 1	0,5	julho 16:00	42	0,2	18,1	2,33
0.1.16 Meeting Room (0)						
0.1.16 Meeting Room (0)	2,3	julho 16:00	208	0,6	50,9	4,08
0.1.17 Storage (East)						
0.1.17 Storage (East)	0,0	julho 19:00	56	0,2	13,2	4,25
0.1.18 Storage (West)						
0.1.18 Storage (West)	0,0	janeiro 7:00	69	0,2	17,8	3,88
0.1.19 Storage (Stairs)						
0.1.19 Storage (Stairs)	0,0	julho 19:00	42	0,1	9,1	4,60
0.1.20 Senior Store						
0.1.20 Senior Store	0,0	julho 19:00	42	0,1	12,9	3,25
0.1.21 Telecom Room						
0.1.21 Telecom Room	12,7	setembro 18:00	1780	0,0	179,7	9,91
0.1.22 HVAC Room (0)						
0.1.22 HVAC Room (0)	4,6	agosto 19:00	333	0,0	204,8	1,62
0.1.23 GSM Room						
0.1.23 GSM Room	3,2	agosto 17:00	447	0,0	16,2	27,61

Air System Heat Balance Summary for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:42

Table 1. System Loads

	DESIGN COOLING - ABRIL 17:00			DESIGN HEATING		
	OA DB / WB 39,3 C / 22,9 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	28563	3040	-	10669	0
Plenum Load	-	952	0	-	1714	0
Exhaust Fan Load	1126 L/s	938	-	1126 L/s	-938	-
Ventilation Load	2447 L/s	33836	420	2447 L/s	37373	25571
Ventilation Fan Load	2447 L/s	4078	-	2447 L/s	-4078	-
Zone Fan Coil Fans Load	-	575	-	-	-575	-
>> Total System Loads	**-**	**68943**	**3460**	**-**	**44165**	**25571**
Cooling Coil	-	41788	0	-	0	0
Heating Coil	-	0	-	-	35729	-
Terminal Unit Cooling	-	27916	3539	-	0	0
Terminal Unit Heating	-	0	-	-	7314	-
Dehumidification Reheat Coil	-	0	-	-	0	-
Humidification	0,00 kg/hr	0	0	37,48 kg/hr	1397	23510
>> Total Conditioning	**-**	**69704**	**3539**	**-**	**44440**	**23510**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - ABRIL 17:00			DESIGN HEATING		
	OA DB / WB 39,3 C / 22,9 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	457 sqm	2857	-	457 sqm	1147	-
Roof Convection	205 sqm	755	-	205 sqm	172	-
Window Convection	22 sqm	-115	-	22 sqm	1181	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	12 sqm	119	-	12 sqm	102	-
Floor Convection	993 sqm	4360	-	993 sqm	1712	-
Interior Wall Convection	1742 sqm	3954	-	1742 sqm	2139	-
Ceiling Convection	789 sqm	3730	-	789 sqm	1490	-
Overhead Lighting Convection	14900 W	2101	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	8346 W	6260	-	0 W	0	-
People Convection	48	1034	2884	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
DOAS Ventilation	2447 L/s	-1705	-	2447 L/s	-2369	-
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	2335	288	10%	717	0
>> Total Zone Loads	**-**	**25685**	**3172**	**-**	**7883**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN COOLING DAY AT ABRIL 17:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	39,2	0,01101	2447	400	33836	420
Air-to-Air Energy Recovery	Outlet	36,7	0,01106	2447	400	7391	-389
Vent - Return Mixing	Outlet	36,7	0,01106	2447	400	-	-
Vent. Heating Coil	Outlet	36,7	0,01106	2447	400	0	-
Vent. Cooling Coil	Outlet	22,6	0,01106	2447	400	41788	0
Ventilation Fan	Outlet	24,0	0,01106	2447	400	4078	-
Humidifier	Outlet	24,0	0,01106	2447	400	0	0
Dehumid. Reheat Coil	Outlet	24,0	0,01106	2447	400	0	-
Cold Supply Duct	Outlet	24,0	0,01106	2447	400	0	-
Zone Air	-	24,3	0,01072	1126	472	28563	3040
Zone Direct Exhaust	Outlet	24,5	0,01076	1321	421	-	-
Return Air Plenum	Outlet	25,0	0,01129	1126	610	952	-
Exhaust Fan	Outlet	25,7	0,01129	1126	610	938	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
0.1.01 Corridor (0) (Cooling)							
Ventilation Air	-	-	-	69	-	-	-
Cooling Coil Inlet	-	25,7	0,01107	69	400	-	-
Cooling Coil Outlet	-	23,6	0,01107	69	400	174	0
Heating Coil Inlet	-	23,6	0,01107	69	400	-	-
Heating Coil Outlet	-	23,6	0,01107	69	400	0	-
Zone Air	-	25,6	0,01107	69	400	299	-
0.1.02 Lobby (North) (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,4	0,01106	167	400	-	-
Cooling Coil Outlet	-	25,4	0,01106	167	400	0	0
Heating Coil Inlet	-	25,4	0,01106	167	400	-	-
Heating Coil Outlet	-	25,4	0,01106	167	400	0	-
Zone Air	-	25,3	0,01106	167	400	244	-
0.1.03 Lobby (West) (Deadband)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	25,1	0,01106	111	400	-	-
Cooling Coil Outlet	-	25,1	0,01106	111	400	0	0
Heating Coil Inlet	-	25,1	0,01106	111	400	-	-
Heating Coil Outlet	-	25,1	0,01106	111	400	0	-
Zone Air	-	25,0	0,01106	111	400	123	-
0.1.04 Corridor (SW) (Cooling)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	25,7	0,01106	111	400	-	-
Cooling Coil Outlet	-	25,7	0,01106	111	400	0	0
Heating Coil Inlet	-	25,7	0,01106	111	400	-	-
Heating Coil Outlet	-	25,7	0,01106	111	400	0	-
Zone Air	-	25,6	0,01106	111	400	203	-
0.1.05 Corridor (SE) (Cooling)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	25,7	0,01106	111	400	-	-
Cooling Coil Outlet	-	25,4	0,01106	111	400	46	0
Heating Coil Inlet	-	25,4	0,01106	111	400	-	-

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Heating Coil Outlet	-	25,4	0,01106	111	400	0	-
Zone Air	-	25,6	0,01106	111	400	249	-
0.1.06 Washroom (Senior Office) (Deadband)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	24,8	0,01106	56	400	-	-
Cooling Coil Outlet	-	24,8	0,01106	56	400	0	0
Heating Coil Inlet	-	24,8	0,01106	56	400	-	-
Heating Coil Outlet	-	24,8	0,01106	56	400	0	-
Zone Air	-	24,7	0,01106	56	400	43	-
0.1.07 Toilets M (Deadband)							
Ventilation Air	-	-	-	181	-	-	-
Cooling Coil Inlet	-	24,9	0,01106	181	400	-	-
Cooling Coil Outlet	-	24,9	0,01106	181	400	0	0
Heating Coil Inlet	-	24,9	0,01106	181	400	-	-
Heating Coil Outlet	-	24,9	0,01106	181	400	0	-
Zone Air	-	24,8	0,01106	181	400	153	-
0.1.08 Toilets F (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,0	0,01106	167	400	-	-
Cooling Coil Outlet	-	25,0	0,01106	167	400	0	0
Heating Coil Inlet	-	25,0	0,01106	167	400	-	-
Heating Coil Outlet	-	25,0	0,01106	167	400	0	-
Zone Air	-	24,9	0,01106	167	400	161	-
0.1.09 Dinning Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	24,1	0,01209	167	729	-	-
Cooling Coil Outlet	-	17,5	0,01184	167	729	1335	127
Heating Coil Inlet	-	17,5	0,01184	167	729	-	-
Heating Coil Outlet	-	17,5	0,01184	167	729	0	-
Zone Air	-	24,0	0,01210	167	729	1315	-
0.1.10 Kitchen / Tea Prep (0) (Cooling)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	24,1	0,01067	132	731	-	-
Cooling Coil Outlet	-	14,9	0,00961	132	731	1466	423
Heating Coil Inlet	-	14,9	0,00961	132	731	-	-
Heating Coil Outlet	-	14,9	0,00961	132	731	0	-
Zone Air	-	24,0	0,01068	132	731	1450	-
0.1.11 Pantry (0) (Cooling)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	24,1	0,01106	153	400	-	-
Cooling Coil Outlet	-	22,6	0,01106	153	400	270	0
Heating Coil Inlet	-	22,6	0,01106	153	400	-	-
Heating Coil Outlet	-	22,6	0,01106	153	400	0	-
Zone Air	-	24,0	0,01106	153	400	252	-
0.1.12 Prayer Room F (Cooling)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	24,1	0,01137	90	731	-	-
Cooling Coil Outlet	-	15,8	0,01040	90	731	902	261
Heating Coil Inlet	-	15,8	0,01040	90	731	-	-
Heating Coil Outlet	-	15,8	0,01040	90	731	0	-
Zone Air	-	24,0	0,01136	90	731	891	-
0.1.13 Muster Room (Cooling)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	24,1	0,01124	176	759	-	-
Cooling Coil Outlet	-	15,5	0,01016	176	759	1840	568
Heating Coil Inlet	-	15,5	0,01016	176	759	-	-
Heating Coil Outlet	-	15,5	0,01016	176	759	0	-
Zone Air	-	24,0	0,01124	176	759	1818	-
0.1.14 Senior Office (Cooling)							

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	24,1	0,01088	81	662	-	-
Cooling Coil Outlet	-	16,1	0,01028	81	662	791	145
Heating Coil Inlet	-	16,1	0,01028	81	662	-	-
Heating Coil Outlet	-	16,1	0,01028	81	662	0	-
Zone Air	-	24,0	0,01089	81	662	781	-
0.1.15 Office 1 (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	24,1	0,01086	42	596	-	-
Cooling Coil Outlet	-	16,0	0,01024	42	596	412	78
Heating Coil Inlet	-	16,0	0,01024	42	596	-	-
Heating Coil Outlet	-	16,0	0,01024	42	596	0	-
Zone Air	-	24,0	0,01087	42	596	407	-
0.1.16 Meeting Room (0) (Cooling)							
Ventilation Air	-	-	-	208	-	-	-
Cooling Coil Inlet	-	24,1	0,01151	208	796	-	-
Cooling Coil Outlet	-	15,6	0,01037	208	796	2146	706
Heating Coil Inlet	-	15,6	0,01037	208	796	-	-
Heating Coil Outlet	-	15,6	0,01037	208	796	0	-
Zone Air	-	24,0	0,01151	208	796	2121	-
0.1.17 Storage (East) (Deadband)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	25,5	0,01106	56	400	-	-
Cooling Coil Outlet	-	25,5	0,01106	56	400	0	0
Heating Coil Inlet	-	25,5	0,01106	56	400	-	-
Heating Coil Outlet	-	25,5	0,01106	56	400	0	-
Zone Air	-	25,4	0,01106	56	400	90	-
0.1.18 Storage (West) (Deadband)							
Ventilation Air	-	-	-	69	-	-	-
Cooling Coil Inlet	-	25,3	0,01106	69	400	-	-
Cooling Coil Outlet	-	25,3	0,01106	69	400	0	0
Heating Coil Inlet	-	25,3	0,01106	69	400	-	-
Heating Coil Outlet	-	25,3	0,01106	69	400	0	-
Zone Air	-	25,2	0,01106	69	400	91	-
0.1.19 Storage (Stairs) (Deadband)							
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	25,4	0,01106	42	400	-	-
Cooling Coil Outlet	-	25,4	0,01106	42	400	0	0
Heating Coil Inlet	-	25,4	0,01106	42	400	-	-
Heating Coil Outlet	-	25,4	0,01106	42	400	0	-
Zone Air	-	25,3	0,01106	42	400	63	-
0.1.20 Senior Store (Deadband)							
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	25,5	0,01106	42	400	-	-
Cooling Coil Outlet	-	25,5	0,01106	42	400	0	0
Heating Coil Inlet	-	25,5	0,01106	42	400	-	-
Heating Coil Outlet	-	25,5	0,01106	42	400	0	-
Zone Air	-	25,4	0,01106	42	400	66	-
0.1.21 Telecom Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	20,4	0,00882	1780	400	-	-
Cooling Coil Outlet	-	14,6	0,00861	1780	400	12672	1123
Heating Coil Inlet	-	14,6	0,00861	1780	400	-	-
Heating Coil Outlet	-	14,6	0,00861	1780	400	0	-
Zone Air	-	20,3	0,00882	1780	400	11718	-
0.1.22 HVAC Room (0) (Cooling)							
Ventilation Air	-	-	-	167	-	-	-

System Psychrometrics for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Cooling Coil Inlet	-	25,7	0,01107	333	400	-	-
Cooling Coil Outlet	-	19,1	0,01107	333	400	2687	0
Heating Coil Inlet	-	19,1	0,01107	333	400	-	-
Heating Coil Outlet	-	19,1	0,01107	333	400	0	-
Zone Air	-	25,6	0,01107	333	400	2972	-
0.1.23 GSM Room (Cooling)							
Ventilation Air	-	-	-	14	-	-	-
Cooling Coil Inlet	-	20,1	0,00844	447	400	-	-
Cooling Coil Outlet	-	14,2	0,00836	447	400	3175	110
Heating Coil Inlet	-	14,2	0,00836	447	400	-	-
Heating Coil Outlet	-	14,2	0,00836	447	400	0	-
Zone Air	-	20,0	0,00844	447	400	3055	-

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2447	400	-37373	-25571
Air-to-Air Energy Recovery	Outlet	7,5	0,00425	2447	400	-8654	-5979
Vent - Return Mixing	Outlet	7,5	0,00425	2447	400	-	-
Vent. Heating Coil	Outlet	19,6	0,00425	2447	400	35729	-
Vent. Cooling Coil	Outlet	19,6	0,00425	2447	400	0	0
Ventilation Fan	Outlet	21,0	0,00425	2447	400	4078	-
Humidifier	Outlet	21,5	0,00785	2447	400	1397	23510
Dehumid. Reheat Coil	Outlet	21,5	0,00785	2447	400	0	-
Cold Supply Duct	Outlet	21,5	0,00785	2447	400	0	-
Zone Air	-	19,4	0,00785	1126	400	-10669	0
Zone Direct Exhaust	Outlet	20,2	0,00785	1321	400	-	-
Return Air Plenum	Outlet	19,7	0,00785	1126	400	-1714	-
Exhaust Fan	Outlet	20,4	0,00785	1126	400	938	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
0.1.01 Corridor (0) (Heating)							
Ventilation Air	-	-	-	69	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	69	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	69	400	0	0
Heating Coil Inlet	-	21,1	0,00785	69	400	-	-
Heating Coil Outlet	-	32,8	0,00785	69	400	979	-
Zone Air	-	21,0	0,00785	69	400	-1028	-
0.1.02 Lobby (North) (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	167	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	167	400	0	0
Heating Coil Inlet	-	21,1	0,00785	167	400	-	-
Heating Coil Outlet	-	22,4	0,00785	167	400	259	-
Zone Air	-	21,0	0,00785	167	400	-376	-
0.1.03 Lobby (West) (Heating)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	111	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	111	400	0	0
Heating Coil Inlet	-	21,1	0,00785	111	400	-	-
Heating Coil Outlet	-	21,9	0,00785	111	400	109	-
Zone Air	-	21,0	0,00785	111	400	-187	-
0.1.04 Corridor (SW) (Heating)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	111	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	111	400	0	0
Heating Coil Inlet	-	21,1	0,00785	111	400	-	-
Heating Coil Outlet	-	31,2	0,00785	111	400	1348	-
Zone Air	-	21,0	0,00785	111	400	-1426	-
0.1.05 Corridor (SE) (Heating)							
Ventilation Air	-	-	-	111	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	111	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	111	400	0	0
Heating Coil Inlet	-	21,1	0,00785	111	400	-	-
Heating Coil Outlet	-	27,9	0,00785	111	400	910	-

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Zone Air	-	21,0	0,00785	111	400	-987	-
0.1.06 Washroom (Senior Office) (Deadband)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	21,2	0,00785	56	400	-	-
Cooling Coil Outlet	-	21,2	0,00785	56	400	0	0
Heating Coil Inlet	-	21,2	0,00785	56	400	-	-
Heating Coil Outlet	-	21,2	0,00785	56	400	0	-
Zone Air	-	21,1	0,00785	56	400	-34	-
0.1.07 Toilets M (Heating)							
Ventilation Air	-	-	-	181	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	181	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	181	400	0	0
Heating Coil Inlet	-	21,1	0,00785	181	400	-	-
Heating Coil Outlet	-	21,5	0,00785	181	400	87	-
Zone Air	-	21,0	0,00785	181	400	-214	-
0.1.08 Toilets F (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	167	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	167	400	0	0
Heating Coil Inlet	-	21,1	0,00785	167	400	-	-
Heating Coil Outlet	-	21,6	0,00785	167	400	99	-
Zone Air	-	21,0	0,00785	167	400	-216	-
0.1.09 Dinning Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	167	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	167	400	0	0
Heating Coil Inlet	-	21,1	0,00785	167	400	-	-
Heating Coil Outlet	-	23,1	0,00785	167	400	405	-
Zone Air	-	21,0	0,00785	167	400	-522	-
0.1.10 Kitchen / Tea Prep (0) (Heating)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	132	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	132	400	0	0
Heating Coil Inlet	-	21,1	0,00785	132	400	-	-
Heating Coil Outlet	-	22,2	0,00785	132	400	175	-
Zone Air	-	21,0	0,00785	132	400	-239	-
0.1.11 Pantry (0) (Heating)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	153	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	153	400	0	0
Heating Coil Inlet	-	21,1	0,00785	153	400	-	-
Heating Coil Outlet	-	21,5	0,00785	153	400	69	-
Zone Air	-	21,0	0,00785	153	400	-176	-
0.1.12 Prayer Room F (Heating)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	90	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	90	400	0	0
Heating Coil Inlet	-	21,1	0,00785	90	400	-	-
Heating Coil Outlet	-	24,9	0,00785	90	400	415	-
Zone Air	-	21,0	0,00785	90	400	-474	-
0.1.13 Muster Room (Heating)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	176	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	176	400	0	0
Heating Coil Inlet	-	21,1	0,00785	176	400	-	-
Heating Coil Outlet	-	25,3	0,00785	176	400	890	-
Zone Air	-	21,0	0,00785	176	400	-1000	-
0.1.14 Senior Office (Heating)							
Ventilation Air	-	-	-	42	-	-	-

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Cooling Coil Inlet	-	21,1	0,00785	81	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	81	400	0	0
Heating Coil Inlet	-	21,1	0,00785	81	400	-	-
Heating Coil Outlet	-	25,2	0,00785	81	400	406	-
Zone Air	-	21,0	0,00785	81	400	-440	-
0.1.15 Office 1 (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	42	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	42	400	0	0
Heating Coil Inlet	-	21,1	0,00785	42	400	-	-
Heating Coil Outlet	-	25,1	0,00785	42	400	206	-
Zone Air	-	21,0	0,00785	42	400	-227	-
0.1.16 Meeting Room (0) (Heating)							
Ventilation Air	-	-	-	208	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	208	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	208	400	0	0
Heating Coil Inlet	-	21,1	0,00785	208	400	-	-
Heating Coil Outlet	-	23,0	0,00785	208	400	470	-
Zone Air	-	21,0	0,00785	208	400	-616	-
0.1.17 Storage (East) (Heating)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	56	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	56	400	0	0
Heating Coil Inlet	-	21,1	0,00785	56	400	-	-
Heating Coil Outlet	-	23,1	0,00785	56	400	133	-
Zone Air	-	21,0	0,00785	56	400	-172	-
0.1.18 Storage (West) (Heating)							
Ventilation Air	-	-	-	69	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	69	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	69	400	0	0
Heating Coil Inlet	-	21,1	0,00785	69	400	-	-
Heating Coil Outlet	-	22,6	0,00785	69	400	123	-
Zone Air	-	21,0	0,00785	69	400	-172	-
0.1.19 Storage (Stairs) (Heating)							
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	42	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	42	400	0	0
Heating Coil Inlet	-	21,1	0,00785	42	400	-	-
Heating Coil Outlet	-	23,1	0,00785	42	400	100	-
Zone Air	-	21,0	0,00785	42	400	-129	-
0.1.20 Senior Store (Heating)							
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	42	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	42	400	0	0
Heating Coil Inlet	-	21,1	0,00785	42	400	-	-
Heating Coil Outlet	-	23,7	0,00785	42	400	131	-
Zone Air	-	21,0	0,00785	42	400	-161	-
0.1.21 Telecom Room (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	18,9	0,00785	1780	400	-	-
Cooling Coil Outlet	-	18,9	0,00785	1780	400	0	0
Heating Coil Inlet	-	18,9	0,00785	1780	400	-	-
Heating Coil Outlet	-	18,9	0,00785	1780	400	0	-
Zone Air	-	18,8	0,00785	1780	400	-762	-
0.1.22 HVAC Room (0) (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	16,8	0,00785	333	400	-	-
Cooling Coil Outlet	-	16,8	0,00785	333	400	0	0

System Psychrometrics for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Heating Coil Inlet	-	16,8	0,00785	333	400	-	-
Heating Coil Outlet	-	16,8	0,00785	333	400	0	-
Zone Air	-	16,7	0,00785	333	400	-1008	-
0.1.23 GSM Room (Deadband)							
Ventilation Air	-	-	-	14	-	-	-
Cooling Coil Inlet	-	18,6	0,00785	447	400	-	-
Cooling Coil Outlet	-	18,6	0,00785	447	400	0	0
Heating Coil Inlet	-	18,6	0,00785	447	400	-	-
Heating Coil Outlet	-	18,6	0,00785	447	400	0	-
Zone Air	-	18,5	0,00785	447	400	-104	-

System Psychrometrics for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

The psychrometric graph cannot be generated for this type of system.

DOAS Sizing Summary for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name	**IPS - Control Building - FAHU 1.1 (Offices 1)**		Number of zones	**18**	
Equipment Class	**TERM**		Floor Area	**1173,4**	sqm
Air System Type	**4P-FC**		Location	**Middle East**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone L/s Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space L/s Sizing	**Individual peak space loads**

Cooling Coil Sizing Data

Total coil load	**131,2**	kW	Load occurs at	**julho 14:00**	
Total coil load	**19,2**	L/(s kW)	OA DB / WB	**51,7 / 28,9**	C
Sensible coil load	**99,7**	kW	Entering DB / WB	**48,1 / 27,8**	C
Coil L/s at julho 14:00	**2516**	L/s	Leaving DB / WB	**15,8 / 15,8**	C
Max coil L/s	**2516**	L/s			
Sensible heat ratio	**0,760**				
Water flow @ 6,0 K rise	**5,23**	L/s			

Heating Coil Sizing Data

Max coil load	**39,1**	kW	Load occurs at	**Design Heating**	
Coil L/s at Design Heating	**2516**	L/s	Ent. DB / Lvg DB	**6,5 / 19,6**	C
Max coil L/s	**2516**	L/s			
Water flow @ 5,0 K drop	**1,87**	L/s			

Humidifier Sizing Data

Max steam flow at janeiro 19:00	**43,39**	kg/hr	Air mass flow	**10712,55**	kg/hr
Airflow Rate	**2516**	L/s	Moisture gain	**,00405**	kg/kg

Dehumidification Reheat Coil Sizing Data

Max coil load	**11,8**	kW	Load occurs at	**julho 4:00**	
Coil L/s at julho 4:00	**2516**	L/s	W/sqm	**10,1**	
Max coil L/s	**2516**	L/s	Ent. DB / Lvg DB	**17,1 / 21,0**	C
Water flow @ 5,0 K drop	**0,56**	L/s			

Ventilation Fan Sizing Data

Design L/s	**2516**	L/s	Fan motor BHP	**5,29**	BHP
Design L/(s sqm)	**2,14**	L/(s sqm)	Fan motor kW	**4,19**	kW
			Fan total static	**1000**	Pa

Exhaust Fan Sizing Data

Actual max L/s	**2516**	L/s	Fan motor BHP	**2,64**	BHP
Standard L/s	**2477**	L/s	Fan motor kW	**2,10**	kW
Actual max L/(s sqm)	**2,14**	L/(s sqm)	Fan total static	**500**	Pa

Outdoor Ventilation Air Data

Design airflow L/s	**2516**	L/s	L/s/person	**61,37**	L/s/person
L/(s sqm)	**2,14**	L/(s sqm)			

Zone Sizing Summary for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name **IPS - Control Building - FAHU 1.1 (Offices 1)**
Equipment Class **TERM**
Air System Type **4P-FC**
Number of zones **18**
Floor Area **1173,4** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (C)	Coil Leaving DB / WB (C)	Water Flow @ 6,0 K (L/s)	Time of Peak Coil Load	Zone L/(s sqm)
1.1.01 Corridor (1)	0,2	0,2	25,7 / 18,8	25,2 / 18,7	0,01	abril 19:00	2,45
1.1.02 Lobby (Control Room)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	17,87
1.1.03 Toilets M	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	9,84
1.1.04 Prayer Room M	1,7	1,3	24,1 / 18,9	16,4 / 15,6	0,07	abril 17:00	3,85
1.1.05 Meeting Room (1)	2,3	1,7	24,1 / 18,5	15,4 / 14,6	0,09	abril 15:00	3,93
1.1.06 Office 2	0,6	0,5	24,1 / 18,3	16,1 / 14,9	0,02	julho 16:00	2,81
1.1.07 Office 3	0,6	0,5	24,1 / 18,3	16,1 / 14,9	0,02	julho 16:00	2,76
1.1.08 Office 4	0,6	0,5	24,1 / 18,3	16,1 / 14,9	0,02	julho 16:00	2,79
1.1.09 Office 5	0,6	0,5	24,1 / 18,3	16,1 / 14,9	0,02	julho 16:00	2,81
1.1.10 Kitchen / Tea Prep. (1)	1,9	1,5	24,1 / 18,0	15,0 / 13,9	0,08	abril 15:00	7,48
1.1.11 Pantry (1)	0,4	0,4	24,1 / 18,3	22,1 / 17,7	0,01	abril 19:00	8,54
1.1.12 Storage Room (1)	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	4,25
1.1.13 Control Room Filing	0,0	0,0	-17,8 / -19,5	-17,8 / -19,5	0,00	-	4,40
1.1.14 Control Room Training	1,0	0,9	24,1 / 18,2	16,2 / 15,1	0,04	abril 19:00	2,86
1.1.15 Control Room	7,1	6,3	24,1 / 17,8	15,9 / 14,6	0,28	abril 12:00	1,85
1.1.16 Engineering Room	3,1	2,7	24,1 / 18,2	16,2 / 14,9	0,12	abril 15:00	2,72
1.1.17 HVAC Room (1)	3,3	3,0	25,7 / 18,7	16,6 / 15,2	0,13	julho 19:00	1,19
1.1.18 Corridor (2)	0,9	0,9	25,7 / 19,1	20,2 / 17,3	0,04	agosto 17:00	3,17

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (kW)	Heating Coil Ent/Lvg DB (C)	Htg Coil Water Flow @5,0 K (L/s)	Fan Design Airflow (L/s)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (L/s)
1.1.01 Corridor (1)	1,9	21,1 / 25,4	0,09	361	0,056	0,045	361
1.1.02 Lobby (Control Room)	0,2	21,1 / 22,2	0,01	167	0,026	0,021	167
1.1.03 Toilets M	0,3	21,1 / 21,7	0,02	486	0,076	0,060	486
1.1.04 Prayer Room M	0,4	21,1 / 23,5	0,02	139	0,022	0,017	139
1.1.05 Meeting Room (1)	0,5	21,1 / 23,8	0,03	164	0,026	0,020	153
1.1.06 Office 2	0,3	21,1 / 25,3	0,01	51	0,008	0,006	28
1.1.07 Office 3	0,3	21,1 / 25,4	0,01	50	0,008	0,006	28
1.1.08 Office 4	0,3	21,1 / 25,3	0,01	50	0,008	0,006	28
1.1.09 Office 5	0,3	21,1 / 25,3	0,01	51	0,008	0,006	28
1.1.10 Kitchen / Tea Prep. (1)	0,2	21,1 / 22,5	0,01	136	0,021	0,017	83
1.1.11 Pantry (1)	0,1	21,1 / 21,8	0,01	153	0,024	0,019	153
1.1.12 Storage Room (1)	0,2	21,1 / 23,5	0,01	56	0,009	0,007	56
1.1.13 Control Room Filing	0,2	21,1 / 23,1	0,01	97	0,015	0,012	97
1.1.14 Control Room Training	0,5	21,1 / 25,3	0,02	92	0,014	0,011	42
1.1.15 Control Room	3,7	21,1 / 25,9	0,18	633	0,099	0,079	194
1.1.16 Engineering Room	1,5	21,1 / 25,6	0,07	278	0,043	0,034	167
1.1.17 HVAC Room (1)	0,0	-17,8 / -17,8	0,00	268	0,042	0,033	167
1.1.18 Corridor (2)	1,5	21,1 / 29,9	0,07	139	0,022	0,017	139

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.1.01 Corridor (1)	0,7	agosto 19:00	2,0	147,3
1.1.02 Lobby (Control Room)	0,0	agosto 9:00	0,3	9,3
1.1.03 Toilets M	0,3	julho 16:00	0,6	49,4
1.1.04 Prayer Room M	1,5	julho 17:00	0,5	36,1
1.1.05 Meeting Room (1)	2,0	julho 16:00	0,6	41,9
1.1.06 Office 2	0,6	julho 16:00	0,3	18,1
1.1.07 Office 3	0,6	julho 16:00	0,3	18,1
1.1.08 Office 4	0,6	julho 16:00	0,3	17,9
1.1.09 Office 5	0,6	julho 16:00	0,3	18,0
1.1.10 Kitchen / Tea Prep. (1)	1,6	julho 16:00	0,3	18,2
1.1.11 Pantry (1)	0,4	julho 19:00	0,2	17,9
1.1.12 Storage Room (1)	0,1	julho 19:00	0,2	13,2
1.1.13 Control Room Filing	0,0	dezembro 6:00	0,3	22,1
1.1.14 Control Room Training	1,1	agosto 19:00	0,4	32,1
1.1.15 Control Room	7,5	setembro 12:00	2,8	341,7
1.1.16 Engineering Room	3,3	agosto 15:00	1,4	102,2
1.1.17 HVAC Room (1)	3,5	agosto 19:00	0,0	225,9
1.1.18 Corridor (2)	1,2	agosto 17:00	1,3	43,9

Zone Sizing Summary for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.1.01 Corridor (1)						
1.1.01 Corridor (1)	0,7	agosto 19:00	361	2,0	147,3	2,45
1.1.02 Lobby (Control Room)						
1.1.02 Lobby (Control Room)	0,0	agosto 9:00	167	0,3	9,3	17,87
1.1.03 Toilets M						
1.1.03 Toilets M	0,3	julho 16:00	486	0,6	49,4	9,84
1.1.04 Prayer Room M						
1.1.04 Prayer Room M	1,5	julho 17:00	139	0,5	36,1	3,85
1.1.05 Meeting Room (1)						
1.1.05 Meeting Room (1)	2,0	julho 16:00	164	0,6	41,9	3,93
1.1.06 Office 2						
1.1.06 Office 2	0,6	julho 16:00	51	0,3	18,1	2,81
1.1.07 Office 3						
1.1.07 Office 3	0,6	julho 16:00	50	0,3	18,1	2,76
1.1.08 Office 4						
1.1.08 Office 4	0,6	julho 16:00	50	0,3	17,9	2,79
1.1.09 Office 5						
1.1.09 Office 5	0,6	julho 16:00	51	0,3	18,0	2,81
1.1.10 Kitchen / Tea Prep. (1)						
1.1.10 Kitchen / Tea Prep. (1)	1,6	julho 16:00	136	0,3	18,2	7,48
1.1.11 Pantry (1)						
1.1.11 Pantry (1)	0,4	julho 19:00	153	0,2	17,9	8,54
1.1.12 Storage Room (1)						
1.1.12 Storage Room (1)	0,1	julho 19:00	56	0,2	13,2	4,25
1.1.13 Control Room Filing						
1.1.13 Control Room Filing	0,0	dezembro 6:00	97	0,3	22,1	4,40
1.1.14 Control Room Training						
1.1.14 Control Room Training	1,1	agosto 19:00	92	0,4	32,1	2,86
1.1.15 Control Room						
1.1.15 Control Room	7,5	setembro 12:00	633	2,8	341,7	1,85
1.1.16 Engineering Room						
1.1.16 Engineering Room	3,3	agosto 15:00	278	1,4	102,2	2,72
1.1.17 HVAC Room (1)						
1.1.17 HVAC Room (1)	0,8	julho 19:00	67	0,0	72,3	0,93
1.1.17 HVAC Room (1)	2,8	agosto 19:00	201	0,0	153,6	1,31
1.1.18 Corridor (2)						
1.1.18 Corridor (2)	1,2	agosto 17:00	139	1,3	43,9	3,17

Air System Heat Balance Summary for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025

Prepared by: IPS 16:42

Table 1. System Loads

	DESIGN COOLING - ABRIL 16:00			DESIGN HEATING		
	OA DB / WB 40,4 C / 23,1 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	21515	2542	-	14842	0
Plenum Load	-	2557	0	-	3418	0
Exhaust Fan Load	946 L/s	788	-	946 L/s	-788	-
Ventilation Load	2516 L/s	37116	197	2516 L/s	39739	27380
Ventilation Fan Load	2516 L/s	4193	-	2516 L/s	-4193	-
Zone Fan Coil Fans Load	-	418	-	-	-418	-
>> Total System Loads	**-**	**66587**	**2739**	**-**	**52600**	**27380**
Cooling Coil	-	47824	0	-	0	0
Heating Coil	-	0	-	-	39132	-
Terminal Unit Cooling	-	19595	2763	-	0	0
Terminal Unit Heating	-	0	-	-	12267	-
Dehumidification Reheat Coil	-	0	-	-	0	-
Humidification	0,00 kg/hr	0	0	40,14 kg/hr	1496	25181
>> Total Conditioning	**-**	**67419**	**2763**	**-**	**52896**	**25181**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - ABRIL 16:00			DESIGN HEATING		
	OA DB / WB 40,4 C / 23,1 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	620 sqm	2712	-	620 sqm	2101	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	22 sqm	1376	-	22 sqm	510	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	20 sqm	252	-	20 sqm	181	-
Floor Convection	1173 sqm	2621	-	1173 sqm	1797	-
Interior Wall Convection	1289 sqm	2053	-	1289 sqm	1970	-
Ceiling Convection	1173 sqm	4621	-	1173 sqm	4287	-
Overhead Lighting Convection	17601 W	2482	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	2351 W	1763	-	0 W	0	-
People Convection	41	883	2463	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
DOAS Ventilation	2516 L/s	-2801	-	2516 L/s	-1088	-
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	1596	246	10%	1085	0
>> Total Zone Loads	**-**	**17559**	**2710**	**-**	**11930**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN COOLING DAY AT ABRIL 16:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	40,2	0,01102	2516	400	37116	197
Air-to-Air Energy Recovery	Outlet	38,3	0,01102	2516	400	6061	-6
Vent - Return Mixing	Outlet	38,3	0,01102	2516	400	-	-
Vent. Heating Coil	Outlet	38,3	0,01102	2516	400	0	-
Vent. Cooling Coil	Outlet	22,6	0,01102	2516	400	47824	0
Ventilation Fan	Outlet	24,0	0,01102	2516	400	4193	-
Humidifier	Outlet	24,0	0,01102	2516	400	0	0
Dehumid. Reheat Coil	Outlet	24,0	0,01102	2516	400	0	-
Cold Supply Duct	Outlet	24,0	0,01102	2516	400	0	-
Zone Air	-	24,7	0,01085	946	505	21515	2542
Zone Direct Exhaust	Outlet	25,1	0,01097	1570	435	-	-
Return Air Plenum	Outlet	26,4	0,01102	946	580	2557	-
Exhaust Fan	Outlet	27,1	0,01102	946	580	788	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.1.01 Corridor (1) (Cooling)							
Ventilation Air	-	-	-	361	-	-	-
Cooling Coil Inlet	-	25,7	0,01101	361	400	-	-
Cooling Coil Outlet	-	25,5	0,01101	361	400	81	0
Heating Coil Inlet	-	25,5	0,01101	361	400	-	-
Heating Coil Outlet	-	25,5	0,01101	361	400	0	-
Zone Air	-	25,6	0,01101	361	400	738	-
1.1.02 Lobby (Control Room) (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,4	0,01101	167	400	-	-
Cooling Coil Outlet	-	25,4	0,01101	167	400	0	0
Heating Coil Inlet	-	25,4	0,01101	167	400	-	-
Heating Coil Outlet	-	25,4	0,01101	167	400	0	-
Zone Air	-	25,3	0,01102	167	400	241	-
1.1.03 Toilets M (Deadband)							
Ventilation Air	-	-	-	486	-	-	-
Cooling Coil Inlet	-	25,1	0,01101	486	400	-	-
Cooling Coil Outlet	-	25,1	0,01101	486	400	0	0
Heating Coil Inlet	-	25,1	0,01101	486	400	-	-
Heating Coil Outlet	-	25,1	0,01101	486	400	0	-
Zone Air	-	25,0	0,01101	486	400	520	-
1.1.04 Prayer Room M (Cooling)							
Ventilation Air	-	-	-	139	-	-	-
Cooling Coil Inlet	-	24,1	0,01176	139	795	-	-
Cooling Coil Outlet	-	16,4	0,01092	139	795	1308	349
Heating Coil Inlet	-	16,4	0,01092	139	795	-	-
Heating Coil Outlet	-	16,4	0,01092	139	795	0	-
Zone Air	-	24,0	0,01176	139	795	1291	-
1.1.05 Meeting Room (1) (Cooling)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	24,1	0,01125	164	759	-	-
Cooling Coil Outlet	-	15,5	0,01014	164	759	1728	547
Heating Coil Inlet	-	15,5	0,01014	164	759	-	-

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Heating Coil Outlet	-	15,5	0,01014	164	759	0	-
Zone Air	-	24,0	0,01125	164	759	1707	-
1.1.06 Office 2 (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	24,1	0,01091	51	596	-	-
Cooling Coil Outlet	-	16,4	0,01043	51	596	478	72
Heating Coil Inlet	-	16,4	0,01043	51	596	-	-
Heating Coil Outlet	-	16,4	0,01043	51	596	0	-
Zone Air	-	24,0	0,01091	51	596	472	-
1.1.07 Office 3 (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	24,1	0,01091	50	596	-	-
Cooling Coil Outlet	-	16,3	0,01043	50	596	472	73
Heating Coil Inlet	-	16,3	0,01043	50	596	-	-
Heating Coil Outlet	-	16,3	0,01043	50	596	0	-
Zone Air	-	24,0	0,01092	50	596	465	-
1.1.08 Office 4 (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	24,1	0,01092	50	596	-	-
Cooling Coil Outlet	-	16,3	0,01043	50	596	471	72
Heating Coil Inlet	-	16,3	0,01043	50	596	-	-
Heating Coil Outlet	-	16,3	0,01043	50	596	0	-
Zone Air	-	24,0	0,01092	50	596	464	-
1.1.09 Office 5 (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	24,1	0,01090	51	596	-	-
Cooling Coil Outlet	-	16,3	0,01043	51	596	478	73
Heating Coil Inlet	-	16,3	0,01043	51	596	-	-
Heating Coil Outlet	-	16,3	0,01043	51	596	0	-
Zone Air	-	24,0	0,01091	51	596	471	-
1.1.10 Kitchen / Tea Prep. (1) (Cooling)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	24,1	0,01065	136	731	-	-
Cooling Coil Outlet	-	15,0	0,00963	136	731	1503	417
Heating Coil Inlet	-	15,0	0,00963	136	731	-	-
Heating Coil Outlet	-	15,0	0,00963	136	731	0	-
Zone Air	-	24,0	0,01065	136	731	1486	-
1.1.11 Pantry (1) (Cooling)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	24,1	0,01101	153	400	-	-
Cooling Coil Outlet	-	22,2	0,01101	153	400	350	0
Heating Coil Inlet	-	22,2	0,01101	153	400	-	-
Heating Coil Outlet	-	22,2	0,01101	153	400	0	-
Zone Air	-	24,0	0,01101	153	400	330	-
1.1.12 Storage Room (1) (Cooling)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	25,6	0,01101	56	400	-	-
Cooling Coil Outlet	-	25,6	0,01101	56	400	0	0
Heating Coil Inlet	-	25,6	0,01101	56	400	-	-
Heating Coil Outlet	-	25,6	0,01101	56	400	0	-
Zone Air	-	25,5	0,01101	56	400	94	-
1.1.13 Control Room Filing (Deadband)							
Ventilation Air	-	-	-	97	-	-	-
Cooling Coil Inlet	-	25,0	0,01101	97	400	-	-
Cooling Coil Outlet	-	25,0	0,01101	97	400	0	0
Heating Coil Inlet	-	25,0	0,01101	97	400	-	-
Heating Coil Outlet	-	25,0	0,01101	97	400	0	-
Zone Air	-	24,9	0,01101	97	400	89	-
1.1.14 Control Room Training (Cooling)							

System Psychrometrics for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	24,1	0,01099	92	662	-	-
Cooling Coil Outlet	-	16,4	0,01048	92	662	864	141
Heating Coil Inlet	-	16,4	0,01048	92	662	-	-
Heating Coil Outlet	-	16,4	0,01048	92	662	0	-
Zone Air	-	24,0	0,01099	92	662	852	-
1.1.15 Control Room (Cooling)							
Ventilation Air	-	-	-	194	-	-	-
Cooling Coil Inlet	-	24,1	0,01043	633	542	-	-
Cooling Coil Outlet	-	16,2	0,01012	633	542	6098	589
Heating Coil Inlet	-	16,2	0,01012	633	542	-	-
Heating Coil Outlet	-	16,2	0,01012	633	542	0	-
Zone Air	-	24,0	0,01044	633	542	6019	-
1.1.16 Engineering Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	24,1	0,01080	278	565	-	-
Cooling Coil Outlet	-	16,2	0,01028	278	565	2677	430
Heating Coil Inlet	-	16,2	0,01028	278	565	-	-
Heating Coil Outlet	-	16,2	0,01028	278	565	0	-
Zone Air	-	24,0	0,01080	278	565	2643	-
1.1.17 HVAC Room (1) (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,7	0,01101	268	400	-	-
Cooling Coil Outlet	-	18,8	0,01101	268	400	2261	0
Heating Coil Inlet	-	18,8	0,01101	268	400	-	-
Heating Coil Outlet	-	18,8	0,01101	268	400	0	-
Zone Air	-	25,6	0,01101	268	400	2553	-
1.1.18 Corridor (2) (Cooling)							
Ventilation Air	-	-	-	139	-	-	-
Cooling Coil Inlet	-	25,7	0,01101	139	400	-	-
Cooling Coil Outlet	-	20,8	0,01101	139	400	827	0
Heating Coil Inlet	-	20,8	0,01101	139	400	-	-
Heating Coil Outlet	-	20,8	0,01101	139	400	0	-
Zone Air	-	25,6	0,01101	139	400	1080	-

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	2516	400	-39739	-27380
Air-to-Air Energy Recovery	Outlet	6,7	0,00410	2516	400	-6493	-5020
Vent - Return Mixing	Outlet	6,7	0,00410	2516	400	-	-
Vent. Heating Coil	Outlet	19,6	0,00410	2516	400	39132	-
Vent. Cooling Coil	Outlet	19,6	0,00410	2516	400	0	0
Ventilation Fan	Outlet	21,0	0,00410	2516	400	4193	-
Humidifier	Outlet	21,5	0,00785	2516	400	1496	25181
Dehumid. Reheat Coil	Outlet	21,5	0,00785	2516	400	0	-
Cold Supply Duct	Outlet	21,5	0,00785	2516	400	0	-
Zone Air	-	20,4	0,00785	946	400	-14842	0
Zone Direct Exhaust	Outlet	20,7	0,00785	1570	400	-	-
Return Air Plenum	Outlet	18,0	0,00785	946	400	-3418	-
Exhaust Fan	Outlet	18,7	0,00785	946	400	788	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.1.01 Corridor (1) (Heating)							
Ventilation Air	-	-	-	361	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	361	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	361	400	0	0
Heating Coil Inlet	-	21,1	0,00785	361	400	-	-
Heating Coil Outlet	-	25,4	0,00785	361	400	1856	-
Zone Air	-	21,0	0,00785	361	400	-2119	-
1.1.02 Lobby (Control Room) (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	167	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	167	400	0	0
Heating Coil Inlet	-	21,1	0,00785	167	400	-	-
Heating Coil Outlet	-	22,2	0,00785	167	400	217	-
Zone Air	-	21,0	0,00785	167	400	-338	-
1.1.03 Toilets M (Heating)							
Ventilation Air	-	-	-	486	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	486	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	486	400	0	0
Heating Coil Inlet	-	21,1	0,00785	486	400	-	-
Heating Coil Outlet	-	21,7	0,00785	486	400	343	-
Zone Air	-	21,0	0,00785	486	400	-697	-
1.1.04 Prayer Room M (Heating)							
Ventilation Air	-	-	-	139	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	139	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	139	400	0	0
Heating Coil Inlet	-	21,1	0,00785	139	400	-	-
Heating Coil Outlet	-	23,5	0,00785	139	400	408	-
Zone Air	-	21,0	0,00785	139	400	-510	-
1.1.05 Meeting Room (1) (Heating)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	164	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	164	400	0	0
Heating Coil Inlet	-	21,1	0,00785	164	400	-	-

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Heating Coil Outlet	-	23,8	0,00785	164	400	537	-
Zone Air	-	21,0	0,00785	164	400	-650	-
1.1.06 Office 2 (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	51	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	51	400	0	0
Heating Coil Inlet	-	21,1	0,00785	51	400	-	-
Heating Coil Outlet	-	25,3	0,00785	51	400	257	-
Zone Air	-	21,0	0,00785	51	400	-281	-
1.1.07 Office 3 (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	50	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	50	400	0	0
Heating Coil Inlet	-	21,1	0,00785	50	400	-	-
Heating Coil Outlet	-	25,4	0,00785	50	400	258	-
Zone Air	-	21,0	0,00785	50	400	-281	-
1.1.08 Office 4 (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	50	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	50	400	0	0
Heating Coil Inlet	-	21,1	0,00785	50	400	-	-
Heating Coil Outlet	-	25,3	0,00785	50	400	256	-
Zone Air	-	21,0	0,00785	50	400	-279	-
1.1.09 Office 5 (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	51	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	51	400	0	0
Heating Coil Inlet	-	21,1	0,00785	51	400	-	-
Heating Coil Outlet	-	25,3	0,00785	51	400	257	-
Zone Air	-	21,0	0,00785	51	400	-280	-
1.1.10 Kitchen / Tea Prep. (1) (Heating)							
Ventilation Air	-	-	-	83	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	136	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	136	400	0	0
Heating Coil Inlet	-	21,1	0,00785	136	400	-	-
Heating Coil Outlet	-	22,5	0,00785	136	400	234	-
Zone Air	-	21,0	0,00785	136	400	-301	-
1.1.11 Pantry (1) (Heating)							
Ventilation Air	-	-	-	153	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	153	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	153	400	0	0
Heating Coil Inlet	-	21,1	0,00785	153	400	-	-
Heating Coil Outlet	-	21,8	0,00785	153	400	123	-
Zone Air	-	21,0	0,00785	153	400	-234	-
1.1.12 Storage Room (1) (Heating)							
Ventilation Air	-	-	-	56	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	56	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	56	400	0	0
Heating Coil Inlet	-	21,1	0,00785	56	400	-	-
Heating Coil Outlet	-	23,5	0,00785	56	400	160	-
Zone Air	-	21,0	0,00785	56	400	-201	-
1.1.13 Control Room Filing (Heating)							
Ventilation Air	-	-	-	97	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	97	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	97	400	0	0
Heating Coil Inlet	-	21,1	0,00785	97	400	-	-
Heating Coil Outlet	-	23,1	0,00785	97	400	234	-
Zone Air	-	21,0	0,00785	97	400	-305	-
1.1.14 Control Room Training (Heating)							

System Psychrometrics for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	-	-	-	42	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	92	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	92	400	0	0
Heating Coil Inlet	-	21,1	0,00785	92	400	-	-
Heating Coil Outlet	-	25,3	0,00785	92	400	471	-
Zone Air	-	21,0	0,00785	92	400	-508	-
1.1.15 Control Room (Heating)							
Ventilation Air	-	-	-	194	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	633	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	633	400	0	0
Heating Coil Inlet	-	21,1	0,00785	633	400	-	-
Heating Coil Outlet	-	25,9	0,00785	633	400	3659	-
Zone Air	-	21,0	0,00785	633	400	-3855	-
1.1.16 Engineering Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	278	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	278	400	0	0
Heating Coil Inlet	-	21,1	0,00785	278	400	-	-
Heating Coil Outlet	-	25,6	0,00785	278	400	1520	-
Zone Air	-	21,0	0,00785	278	400	-1656	-
1.1.17 HVAC Room (1) (Deadband)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	18,0	0,00785	268	400	-	-
Cooling Coil Outlet	-	18,0	0,00785	268	400	0	0
Heating Coil Inlet	-	18,0	0,00785	268	400	-	-
Heating Coil Outlet	-	18,0	0,00785	268	400	0	-
Zone Air	-	17,9	0,00785	268	400	-770	-
1.1.18 Corridor (2) (Heating)							
Ventilation Air	-	-	-	139	-	-	-
Cooling Coil Inlet	-	21,1	0,00785	139	400	-	-
Cooling Coil Outlet	-	21,1	0,00785	139	400	0	0
Heating Coil Inlet	-	21,1	0,00785	139	400	-	-
Heating Coil Outlet	-	29,9	0,00785	139	400	1477	-
Zone Air	-	21,0	0,00785	139	400	-1579	-

System Psychrometrics for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

The psychrometric graph cannot be generated for this type of system.

DOAS Sizing Summary for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name **IPS - Control Building - FAHU 1.2 (Tech)**
Equipment Class **TERM**
Air System Type **2P-FC**
Number of zones **8**
Floor Area **808,7** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Cooling Coil Sizing Data

Total coil load **178,9** kW
Total coil load **18,8** L/(s kW)
Sensible coil load **141,5** kW
Coil L/s at julho 14:00 **3363** L/s
Max coil L/s **3363** L/s
Sensible heat ratio **0,791**
Water flow @ 6,0 K rise **7,14** L/s
Load occurs at **julho 14:00**
OA DB / WB **51,7 / 28,9** C
Entering DB / WB **51,6 / 28,9** C
Leaving DB / WB **17,4 / 17,3** C

Heating Coil Sizing Data

Max coil load **32,7** kW
Coil L/s at Design Heating **3363** L/s
Max coil L/s **3363** L/s
Water flow @ 5,0 K drop **1,56** L/s
Load occurs at **Design Heating**
Ent. DB / Lvg DB **4,4 / 12,6** C

Humidifier Sizing Data

Max steam flow at Design Heating **22,76** kg/hr
Airflow Rate **3363** L/s
Air mass flow **14318,88** kg/hr
Moisture gain **,00159** kg/kg

Dehumidification Reheat Coil Sizing Data

No dehumidification reheat coil loads occurred during this calculation.

Ventilation Fan Sizing Data

Design L/s **3363** L/s
Design L/(s sqm) **4,16** L/(s sqm)
Fan motor BHP **7,07** BHP
Fan motor kW **5,61** kW
Fan total static **1000** Pa

Outdoor Ventilation Air Data

Design airflow L/s **3363** L/s
L/(s sqm) **4,16** L/(s sqm)
L/s/person **0,00** L/s/person

Zone Sizing Summary for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Air System Information

Air System Name **IPS - Control Building - FAHU 1.2 (Tech)**
Equipment Class **TERM**
Air System Type **2P-FC**

Number of zones **8**
Floor Area **808,7** sqm
Location **Middle East**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone L/s Sizing **Sum of space airflow rates**
Space L/s Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (C)	Coil Leaving DB / WB (C)	Water Flow @ 6,0 K (L/s)	Time of Peak Coil Load	Zone L/(s sqm)
1.2.01 Marshaling Room	8,0	6,9	25,7 / 18,0	15,0 / 13,6	0,32	outubro 14:00	3,02
1.2.02 Auxiliary Room	7,5	6,4	25,7 / 18,0	15,0 / 13,5	0,30	outubro 12:00	3,26
1.2.03 Server Room	12,1	10,8	26,0 / 17,7	14,7 / 13,1	0,48	outubro 14:00	15,45
1.2.04 UPS Room	27,5	25,9	25,8 / 17,2	14,4 / 12,7	1,10	outubro 14:00	14,68
1.2.05 Security Equipment Room	5,3	5,2	25,7 / 16,9	14,2 / 12,5	0,21	abril 21:00	15,58
1.2.06 Battery Room	2,1	2,1	25,7 / 17,4	25,0 / 17,1	0,08	novembro 15:00	16,28
1.2.07 Machine Room	1,4	1,2	25,7 / 18,6	16,3 / 14,9	0,06	julho 20:00	2,99
1.2.08 Water Tanks	2,7	2,4	25,7 / 19,3	17,5 / 16,2	0,11	outubro 18:00	2,72

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (kW)	Heating Coil Ent/Lvg DB (C)	Htg Coil Water Flow @5,0 K (L/s)	Fan Design Airflow (L/s)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (L/s)
1.2.01 Marshaling Room	0,0	-17,8 / -17,8	0,00	535	0,084	0,066	167
1.2.02 Auxiliary Room	0,0	-17,8 / -17,8	0,00	495	0,077	0,061	167
1.2.03 Server Room	0,0	-17,8 / -17,8	0,00	787	0,123	0,098	167
1.2.04 UPS Room	0,0	-17,8 / -17,8	0,00	1877	0,293	0,233	167
1.2.05 Security Equipment Room	0,0	-17,8 / -17,8	0,00	375	0,059	0,046	14
1.2.06 Battery Room	0,0	-17,8 / -17,8	0,00	2486	0,389	0,308	2486
1.2.07 Machine Room	0,0	-17,8 / -17,8	0,00	108	0,017	0,013	28
1.2.08 Water Tanks	0,0	-17,8 / -17,8	0,00	239	0,037	0,030	167

Zone Sizing Summary for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (kW)	Time of Peak Sensible Cooling Load	Zone Heating Load (kW)	Zone Floor Area (sqm)
1.2.01 Marshaling Room	7,4	agosto 18:00	0,0	177,2
1.2.02 Auxiliary Room	6,8	agosto 19:00	0,0	151,8
1.2.03 Server Room	10,9	agosto 16:00	0,0	51,0
1.2.04 UPS Room	25,9	setembro 15:00	0,0	127,9
1.2.05 Security Equipment Room	5,2	setembro 20:00	0,0	24,1
1.2.06 Battery Room	1,7	setembro 15:00	0,0	152,7
1.2.07 Machine Room	1,5	julho 20:00	0,0	35,9
1.2.08 Water Tanks	3,3	agosto 19:00	0,0	88,2

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (kW)	Time of Peak Sensible Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (sqm)	Space L/(s sqm)
1.2.01 Marshaling Room						
1.2.01 Marshaling Room	7,4	agosto 18:00	535	0,0	177,2	3,02
1.2.02 Auxiliary Room						
1.2.02 Auxiliary Room	6,8	agosto 19:00	495	0,0	151,8	3,26
1.2.03 Server Room						
1.2.03 Server Room	10,9	agosto 16:00	787	0,0	51,0	15,45
1.2.04 UPS Room						
1.2.04 UPS Room	25,9	setembro 15:00	1877	0,0	127,9	14,68
1.2.05 Security Equipment Room						
1.2.05 Security Equipment Room	5,2	setembro 20:00	375	0,0	24,1	15,58
1.2.06 Battery Room						
1.2.06 Battery Room	1,7	setembro 15:00	2486	0,0	152,7	16,28
1.2.07 Machine Room						
1.2.07 Machine Room	1,5	julho 20:00	108	0,0	35,9	2,99
1.2.08 Water Tanks						
1.2.08 Water Tanks	3,3	agosto 19:00	239	0,0	88,2	2,72

Air System Heat Balance Summary for IPS - Control Building - FAHU 1.2

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations
Prepared by: IPS

Table 1. System Loads

	DESIGN COOLING - OUTUBRO 15:00			DESIGN HEATING		
	OA DB / WB 42,8 C / 24,5 C			OA DB / WB 4,5 C / 2,0 C		
COMPONENT LOADS	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Zone Conditioning	-	59766	8	-	-3632	0
Plenum Load	-	0	0	-	0	0
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	3363 L/s	68263	5252	3363 L/s	43339	15511
Ventilation Fan Load	3363 L/s	5604	-	3363 L/s	-5604	-
Zone Fan Coil Fans Load	-	855	-	-	-855	-
>> Total System Loads	**-**	**134489**	**5260**	**-**	**33247**	**15511**
Cooling Coil	-	75619	0	-	0	0
Heating Coil	-	0	-	-	32694	-
Terminal Unit Cooling	-	60564	5445	-	0	0
Terminal Unit Heating	-	0	-	-	0	-
Dehumidification Reheat Coil	-	0	-	-	0	-
Humidification	0,00 kg/hr	0	0	22,76 kg/hr	934	14277
>> Total Conditioning	**-**	**136183**	**5445**	**-**	**33629**	**14277**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Table 2. Zone Heat Balance Loads

	DESIGN COOLING - OUTUBRO 15:00			DESIGN HEATING		
	OA DB / WB 42,8 C / 24,5 C			OA DB / WB 4,5 C / 2,0 C		
Zone Heat Balance Component	**Details**	**Sensible [W]**	**Latent [W]**	**Details**	**Sensible [W]**	**Latent [W]**
Exterior Wall Convection	281 sqm	2050	-	281 sqm	153	-
Roof Convection	0 sqm	0	-	0 sqm	0	-
Window Convection	16 sqm	729	-	16 sqm	-1950	-
Skylight Convection	0 sqm	0	-	0 sqm	0	-
Door Convection	8 sqm	123	-	8 sqm	27	-
Floor Convection	809 sqm	3572	-	809 sqm	-119	-
Interior Wall Convection	807 sqm	3066	-	807 sqm	-140	-
Ceiling Convection	809 sqm	5524	-	809 sqm	59	-
Overhead Lighting Convection	12130 W	1710	-	0 W	0	-
Task Lighting Convection	0 W	0	-	0 W	0	-
Electric Equipment Convection	50240 W	37680	-	0 W	0	-
People Convection	0	0	0	0	0	0
Infiltration	0 L/s	0	0	0 L/s	0	0
Miscellaneous Equipment	-	0	0	-	0	0
DOAS Ventilation	3363 L/s	0	-	3363 L/s	15513	-
Air Internal Energy Change	-	0		-	0	0
Safety Factor	10% / 10%	5445	0	10%	0	0
>> Total Zone Loads	**-**	**59899**	**0**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

System Psychrometrics for IPS - Control Building - FAHU 1.2 (Tec

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations
Prepared by: IPS

DESIGN COOLING DAY AT OUTUBRO 15:00

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	42,7	0,01206	3363	400	68263	5252
Vent - Return Mixing	Outlet	42,7	0,01206	3363	400	-	-
Vent. Heating Coil	Outlet	42,7	0,01206	3363	400	0	-
Vent. Cooling Coil	Outlet	24,2	0,01206	3363	400	75619	0
Ventilation Fan	Outlet	25,6	0,01206	3363	400	5604	-
Humidifier	Outlet	25,6	0,01206	3363	400	0	0
Dehumid. Reheat Coil	Outlet	25,6	0,01206	3363	400	0	-
Cold Supply Duct	Outlet	25,6	0,01206	3363	400	0	-
Zone Air	-	25,6	0,01053	0	400	59766	8
Zone Direct Exhaust	Outlet	25,6	0,01153	3363	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.2.01 Marshaling Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,7	0,00991	535	400	-	-
Cooling Coil Outlet	-	15,0	0,00924	535	400	6917	1077
Heating Coil Inlet	-	15,0	0,00924	535	400	-	-
Heating Coil Outlet	-	15,0	0,00924	535	400	0	-
Zone Air	-	25,6	0,00991	535	400	6850	-
1.2.02 Auxiliary Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,7	0,00993	495	400	-	-
Cooling Coil Outlet	-	15,0	0,00922	495	400	6412	1050
Heating Coil Inlet	-	15,0	0,00922	495	400	-	-
Heating Coil Outlet	-	15,0	0,00922	495	400	0	-
Zone Air	-	25,6	0,00993	495	400	6350	-
1.2.03 Server Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	26,0	0,00944	787	400	-	-
Cooling Coil Outlet	-	14,7	0,00888	787	400	10795	1317
Heating Coil Inlet	-	14,7	0,00888	787	400	-	-
Heating Coil Outlet	-	14,7	0,00888	787	400	0	-
Zone Air	-	25,9	0,00944	787	400	10746	-
1.2.04 UPS Room (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,8	0,00890	1877	400	-	-
Cooling Coil Outlet	-	14,3	0,00862	1877	400	25925	1586
Heating Coil Inlet	-	14,3	0,00862	1877	400	-	-
Heating Coil Outlet	-	14,3	0,00862	1877	400	0	-
Zone Air	-	25,7	0,00890	1877	400	25699	-
1.2.05 Security Equipment Room (Cooling)							
Ventilation Air	-	-	-	14	-	-	-
Cooling Coil Inlet	-	25,7	0,00871	375	400	-	-
Cooling Coil Outlet	-	14,3	0,00858	375	400	5148	141
Heating Coil Inlet	-	14,3	0,00858	375	400	-	-
Heating Coil Outlet	-	14,3	0,00858	375	400	0	-
Zone Air	-	25,6	0,00871	375	400	5102	-

System Psychrometrics for IPS - Control Building - FAHU 1.2 (Tec

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations
Prepared by: IPS

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.2.06 Battery Room (Cooling)							
Ventilation Air	-	-	-	2486	-	-	-
Cooling Coil Inlet	-	25,7	0,01207	2486	400	-	-
Cooling Coil Outlet	-	25,0	0,01207	2486	400	1991	0
Heating Coil Inlet	-	25,0	0,01207	2486	400	-	-
Heating Coil Outlet	-	25,0	0,01207	2486	400	0	-
Zone Air	-	25,6	0,01207	2486	400	1684	-
1.2.07 Machine Room (Cooling)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	25,7	0,01143	108	400	-	-
Cooling Coil Outlet	-	17,6	0,01123	108	400	1062	65
Heating Coil Inlet	-	17,6	0,01123	108	400	-	-
Heating Coil Outlet	-	17,6	0,01123	108	400	0	-
Zone Air	-	25,6	0,01142	108	400	1048	-
1.2.08 Water Tanks (Cooling)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	25,7	0,01170	239	400	-	-
Cooling Coil Outlet	-	17,8	0,01141	239	400	2314	210
Heating Coil Inlet	-	17,8	0,01141	239	400	-	-
Heating Coil Outlet	-	17,8	0,01141	239	400	0	-
Zone Air	-	25,6	0,01169	239	400	2284	-

System Psychrometrics for IPS - Control Building - FAHU 1.2 (Tec

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations
Prepared by: IPS

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
Ventilation Air	Inlet	4,5	0,00343	3363	400	-43339	-15511
Vent - Return Mixing	Outlet	4,5	0,00343	3363	400	-	-
Vent. Heating Coil	Outlet	12,6	0,00343	3363	400	32694	-
Vent. Cooling Coil	Outlet	12,6	0,00343	3363	400	0	0
Ventilation Fan	Outlet	14,0	0,00343	3363	400	5604	-
Humidifier	Outlet	14,2	0,00502	3363	400	934	14277
Dehumid. Reheat Coil	Outlet	14,2	0,00502	3363	400	0	-
Cold Supply Duct	Outlet	14,2	0,00502	3363	400	0	-
Zone Air	-	15,9	0,00502	0	400	3632	0
Zone Direct Exhaust	Outlet	15,3	0,00502	3363	400	-	-
Return Air	Outlet	-17,8	0,00000	0	400	-	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1,207; At site altitude = 1,188 W/(L/s-K)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 2947,6; At site altitude = 2901,7 W/(L/s)
Site Altitude = 132,0 m

TABLE 2: ZONE DATA

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.2.01 Marshaling Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	16,6	0,00502	535	400	-	-
Cooling Coil Outlet	-	16,6	0,00502	535	400	0	0
Heating Coil Inlet	-	16,6	0,00502	535	400	-	-
Heating Coil Outlet	-	16,6	0,00502	535	400	0	-
Zone Air	-	16,5	0,00502	535	400	391	-
1.2.02 Auxiliary Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	16,5	0,00502	495	400	-	-
Cooling Coil Outlet	-	16,5	0,00502	495	400	0	0
Heating Coil Inlet	-	16,5	0,00502	495	400	-	-
Heating Coil Outlet	-	16,5	0,00502	495	400	0	-
Zone Air	-	16,4	0,00502	495	400	379	-
1.2.03 Server Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	15,8	0,00502	787	400	-	-
Cooling Coil Outlet	-	15,8	0,00502	787	400	0	0
Heating Coil Inlet	-	15,8	0,00502	787	400	-	-
Heating Coil Outlet	-	15,8	0,00502	787	400	0	-
Zone Air	-	15,7	0,00502	787	400	189	-
1.2.04 UPS Room (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	17,0	0,00502	1877	400	-	-
Cooling Coil Outlet	-	17,0	0,00502	1877	400	0	0
Heating Coil Inlet	-	17,0	0,00502	1877	400	-	-
Heating Coil Outlet	-	17,0	0,00502	1877	400	0	-
Zone Air	-	16,9	0,00502	1877	400	304	-
1.2.05 Security Equipment Room (Heating)							
Ventilation Air	-	-	-	14	-	-	-
Cooling Coil Inlet	-	18,3	0,00502	375	400	-	-
Cooling Coil Outlet	-	18,3	0,00502	375	400	0	0
Heating Coil Inlet	-	18,3	0,00502	375	400	-	-
Heating Coil Outlet	-	18,3	0,00502	375	400	0	-
Zone Air	-	18,2	0,00502	375	400	21	-

System Psychrometrics for IPS - Control Building - FAHU 1.2 (Tec

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations
Prepared by: IPS

Component	Location	Dry-Bulb Temp (C)	Specific Humidity (kg/kg)	Airflow (L/s)	CO2 Level (ppm)	Sensible Heat (W)	Latent Heat (W)
1.2.06 Battery Room (Heating)							
Ventilation Air	-	-	-	2486	-	-	-
Cooling Coil Inlet	-	15,2	0,00502	2486	400	-	-
Cooling Coil Outlet	-	15,2	0,00502	2486	400	0	0
Heating Coil Inlet	-	15,2	0,00502	2486	400	-	-
Heating Coil Outlet	-	15,2	0,00502	2486	400	0	-
Zone Air	-	15,1	0,00502	2486	400	2307	-
1.2.07 Machine Room (Heating)							
Ventilation Air	-	-	-	28	-	-	-
Cooling Coil Inlet	-	16,0	0,00502	108	400	-	-
Cooling Coil Outlet	-	16,0	0,00502	108	400	0	0
Heating Coil Inlet	-	16,0	0,00502	108	400	-	-
Heating Coil Outlet	-	16,0	0,00502	108	400	0	-
Zone Air	-	15,9	0,00502	108	400	43	-
1.2.08 Water Tanks (Heating)							
Ventilation Air	-	-	-	167	-	-	-
Cooling Coil Inlet	-	14,5	0,00502	239	400	-	-
Cooling Coil Outlet	-	14,5	0,00502	239	400	0	0
Heating Coil Inlet	-	14,5	0,00502	239	400	-	-
Heating Coil Outlet	-	14,5	0,00502	239	400	0	-
Zone Air	-	14,4	0,00502	239	400	-2	-

System Psychrometrics for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

The psychrometric graph cannot be generated for this type of system.

Plant Sizing Summary for IPS - Chiller
(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

1. Plant Information:

Plant ..... **IPS - Chiller**
Type ..... **Chiller Plant**
Design Weather ..... **Middle East**

2. Cooling Plant Sizing Data:

Maximum Plant Load ..... **539,1** kW
Load occurs at ..... **agosto 14:00**
sqm/kW ..... **5,5** sqm/kW
Floor area served by plant ..... **2975,4** sqm

3. Coincident Cooling Loads for agosto 14:00

Air System	System Cooling Coil Load [kW]
IPS - Control Building - FAHU 0.1 (Offices 0)	150,8
IPS - Control Building - FAHU 1.1 (Offices 1)	151,8
IPS - Control Building - FAHU 1.2 (Tech)	236,5

Air system loads are for coils whose cooling source is 'Chilled Water'.

4. Chiller Design Capacities

CH-1 ..... **593,0** kW
Total: ..... **593,0** kW

Plant Sizing Summary for IPS - Heat Pump
(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-03-2025
Prepared by: IPS 16:42

1. Plant Information:

Plant ..... **IPS - Heat Pump**
Type ..... **Hot Water Plant**
Design Weather ..... **Middle East**

2. Heating Plant Sizing Data:

Maximum Plant Load ..... **127,1** kW
Load occurs at ..... **Design Heating**
W/sqm ..... **42,7** W/sqm
Floor area served by plant ..... **2975,4** sqm

3. Coincident Heating Loads for Design Heating

Air System	System Heating Coil Load [kW]
IPS - Control Building - FAHU 0.1 (Offices 0)	43,0
IPS - Control Building - FAHU 1.1 (Offices 1)	51,4
IPS - Control Building - FAHU 1.2 (Tech)	32,7

Air system loads are for coils whose heating source is ' Hot Water ' .

4. Boiler & Heat Pump Design Capacities

HP-1 ..... **139,8** kW
Total: ..... **139,8** kW

Annual Cost Summary

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Table 1. Annual Costs

Component	IPS - Control Building (€)
Air System Fans	11 308
Cooling	38 490
Heating	27 603
Pumps	27
Heat Rejection Fans	0
HVAC Sub-Total	**77 428**
Lights	5 815
Electric Equipment	37 144
Misc. Electric	1 703
Misc. Fuel Use	0
Non-HVAC Sub-Total	**44 662**
Grand Total	**122 089**

Table 2. Annual Cost per Unit Floor Area

Component	IPS - Control Building (€/sqm)
Air System Fans	3,801
Cooling	12,936
Heating	9,277
Pumps	0,009
Heat Rejection Fans	0,000
HVAC Sub-Total	**26,023**
Lights	1,954
Electric Equipment	12,484
Misc. Electric	0,572
Misc. Fuel Use	0,000
Non-HVAC Sub-Total	**15,010**
Grand Total	**41,033**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	IPS - Control Building (%)
Air System Fans	9,3
Cooling	31,5
Heating	22,6
Pumps	0,0
Heat Rejection Fans	0,0
HVAC Sub-Total	**63,4**
Lights	4,8
Electric Equipment	30,4
Misc. Electric	1,4
Misc. Fuel Use	0,0
Non-HVAC Sub-Total	**36,6**
Grand Total	**100,0**

Table 1. Annual Costs

Component	IPS - Control Building (€)
HVAC Components	
Electric	77 427
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**77 427**
Non-HVAC Components	
Electric	44 661
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**44 661**
Grand Total	**122 088**

Table 2. Annual Energy Consumption

Component	IPS - Control Building
HVAC Components	
Electric (kWh)	1 075 372
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	620 293
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	1 695 665
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	IPS - Control Building
CO2 Equivalent (kg)	610 449

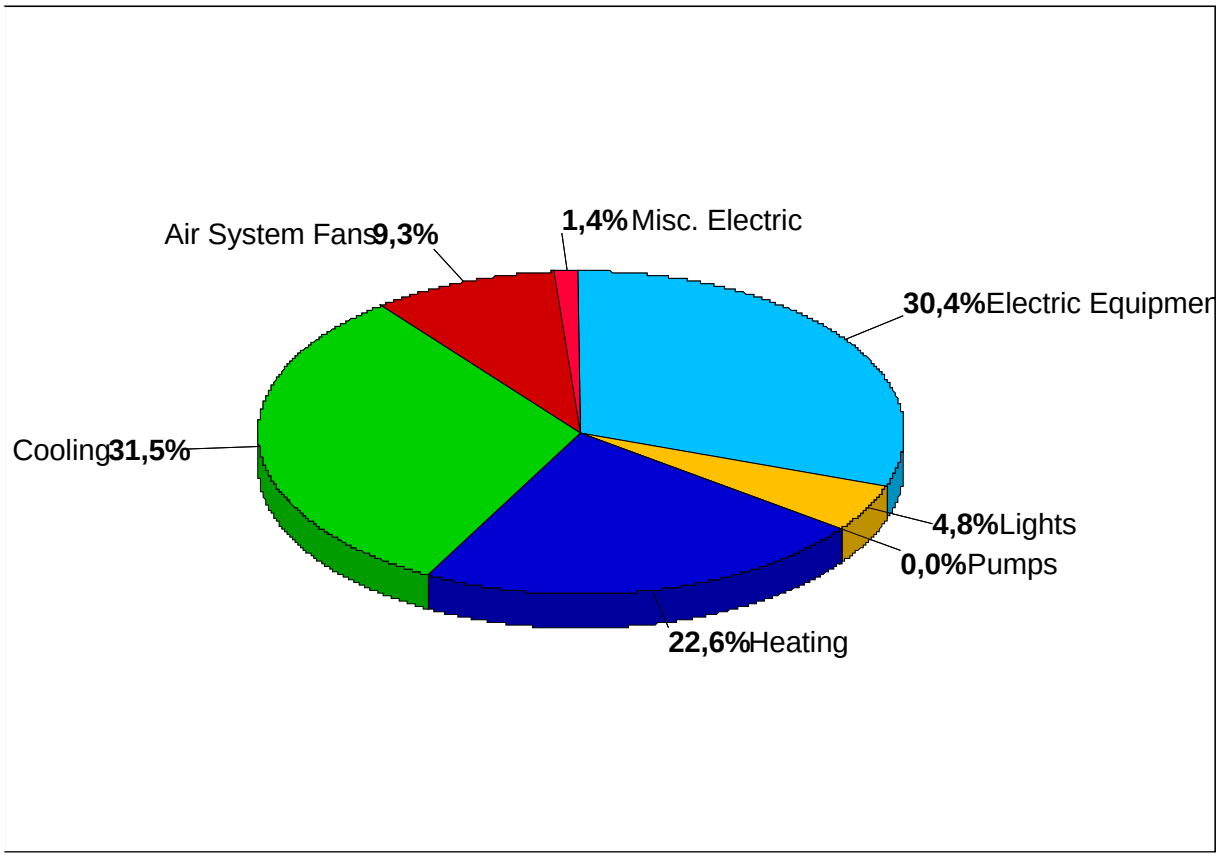
Table 4. Annual Cost per Unit Floor Area

Component	IPS - Control Building (€/sqm)
HVAC Components	
Electric	26,022
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Remote CW	0,000
HVAC Sub-Total	**26,022**
Non-HVAC Components	
Electric	15,010
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Non-HVAC Sub-Total	**15,010**
Grand Total	**41,032**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	IPS - Control Building (%)
HVAC Components	
Electric	63,4
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Remote CW	0,0
HVAC Sub-Total	**63,4**
Non-HVAC Components	
Electric	36,6
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Non-HVAC Sub-Total	**36,6**
Grand Total	**100,0**

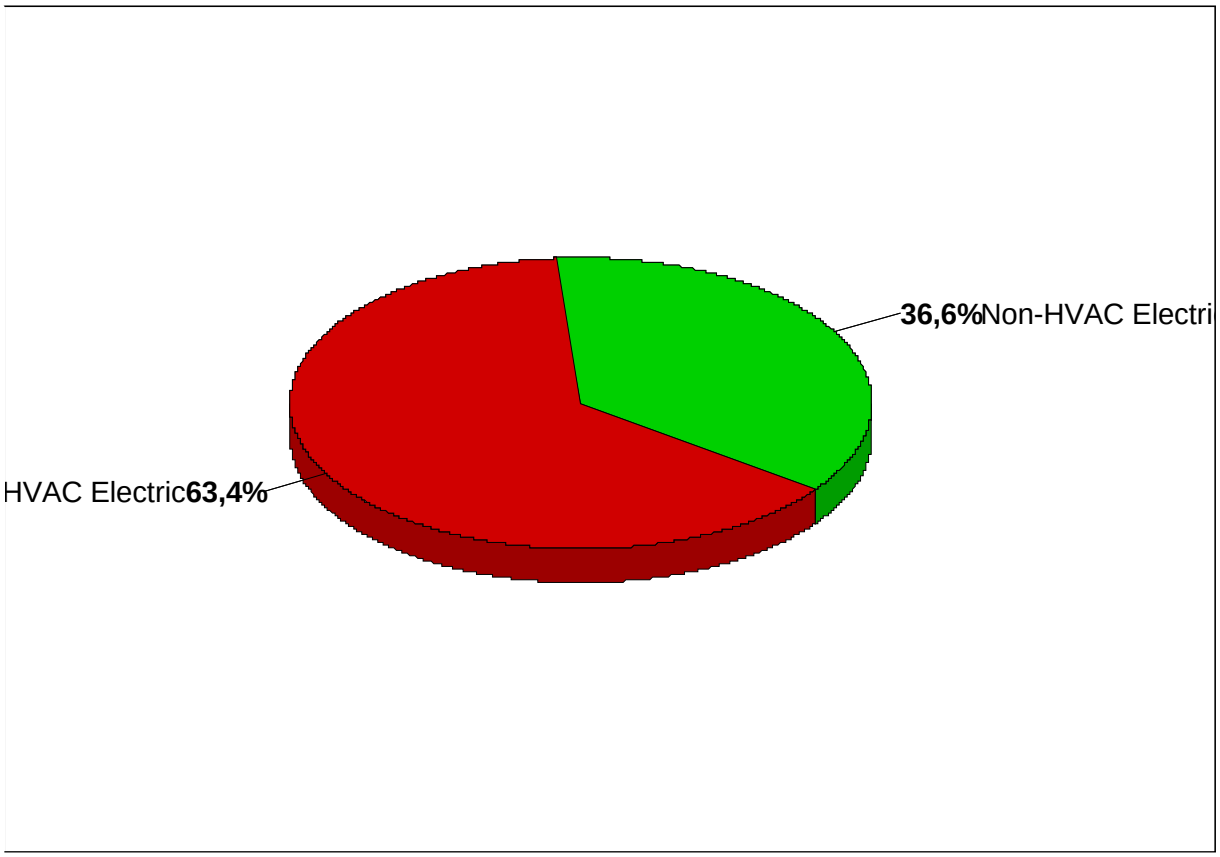


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	11 308	3,801	9,3
Cooling	38 490	12,936	31,5
Heating	27 603	9,277	22,6
Pumps	27	0,009	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**77 428**	**26,023**	**63,4**
Lights	5 815	1,954	4,8
Electric Equipment	37 144	12,484	30,4
Misc. Electric	1 703	0,572	1,4
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**44 662**	**15,010**	**36,6**
Grand Total	**122 089**	**41,033**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

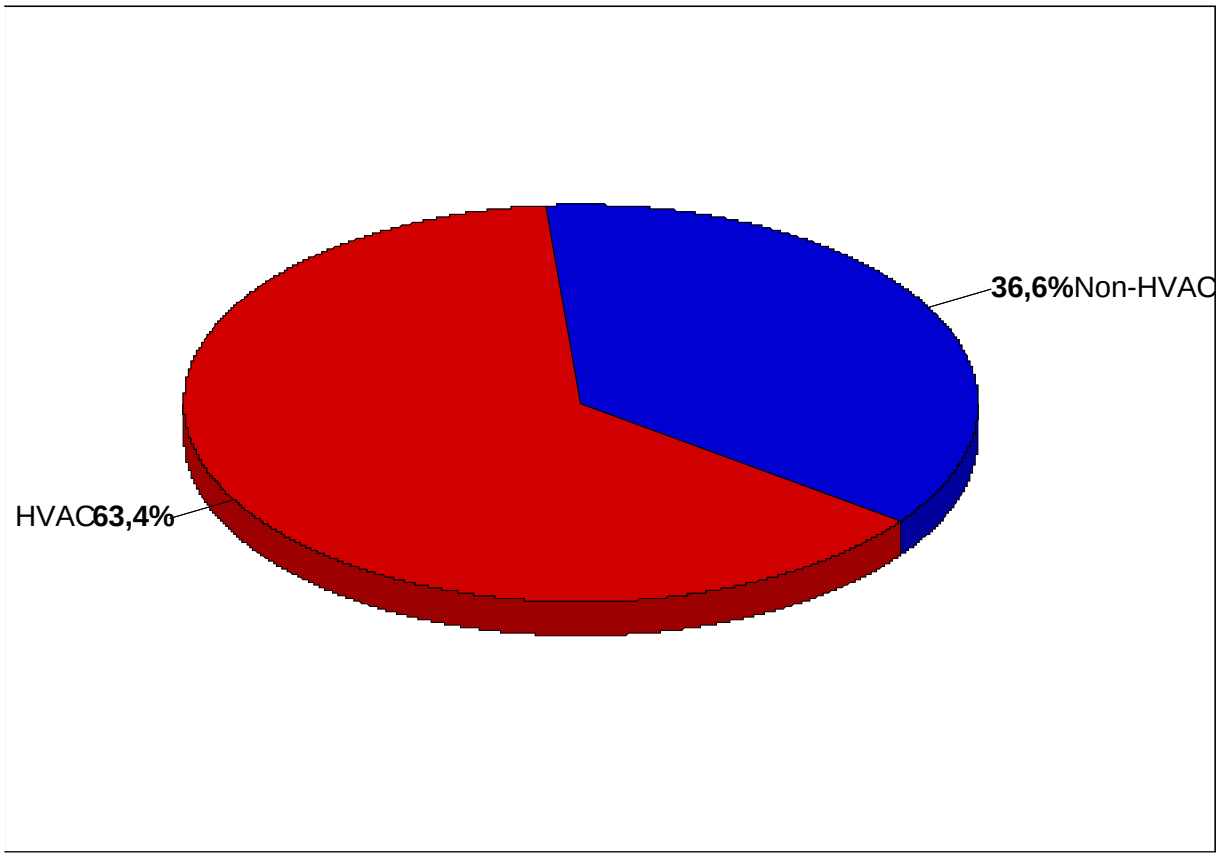


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC Components			
Electric	77 427	26,022	63,4
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Remote Chilled Water	0	0,000	0,0
HVAC Sub-Total	**77 427**	**26,022**	**63,4**
Non-HVAC Components			
Electric	44 661	15,010	36,6
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Non-HVAC Sub-Total	**44 661**	**15,010**	**36,6**
Grand Total	**122 088**	**41,032**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm



1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC	77 428	26,023	63,4
Non-HVAC	44 662	15,010	36,6
Grand Total	**122 089**	**41,033**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

Energy Budget by System Component - IPS - Control Building

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	157 059	52,786	392 647	131,964
Cooling	534 581	179,667	1 336 452	449,166
Heating	383 373	128,847	958 432	322,118
Pumps	369	0,124	923	0,310
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 075 381**	**361,423**	**2 688 453**	**903,559**
Lights	80 760	27,143	201 900	67,856
Electric Equipment	515 885	173,383	1 289 712	433,458
Misc. Electric	23 652	7,949	59 129	19,873
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 296**	**208,475**	**1 550 741**	**521,187**
Grand Total	**1 695 677**	**569,898**	**4 239 194**	**1424,745**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

Energy Budget by Energy Source - IPS - Control Building

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

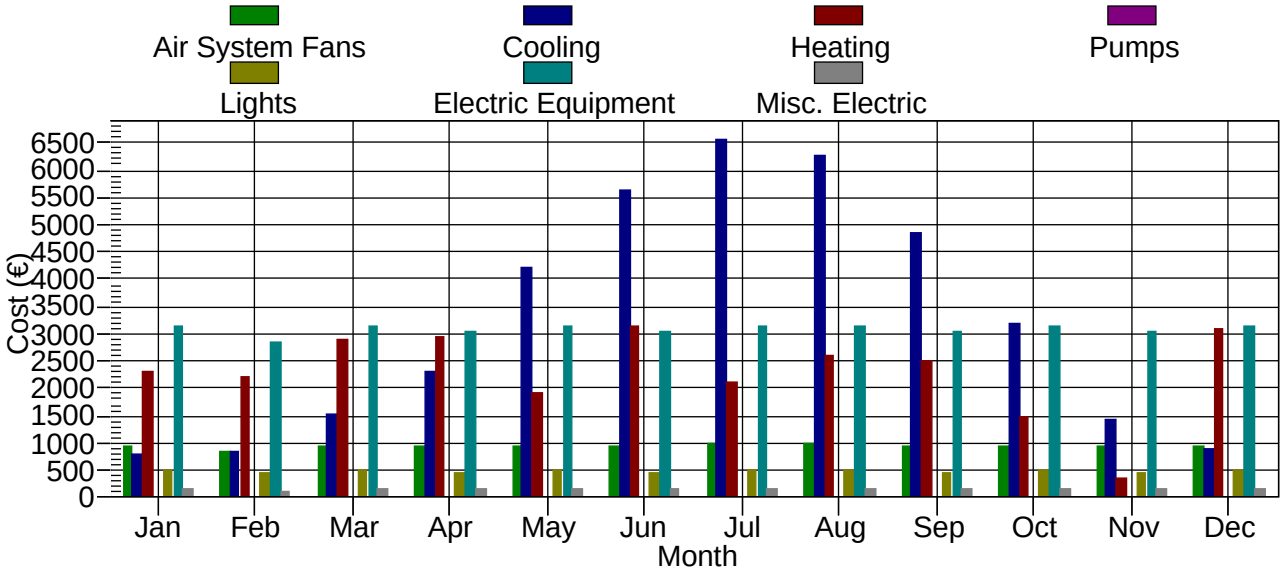
2. Energy Consumption by Energy Source

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
HVAC Components				
Electric	1 075 366	361,418	2 688 415	903,546
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Remote Chilled Water	0	0,000	0	0,000
HVAC Sub-Total	**1 075 366**	**361,418**	**2 688 415**	**903,546**
Non-HVAC Components				
Electric	620 289	208,472	1 550 724	521,181
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 289**	**208,472**	**1 550 724**	**521,181**
Grand Total	**1 695 655**	**569,891**	**4 239 139**	**1424,727**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

Monthly Component Costs - IPS - Control Building

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

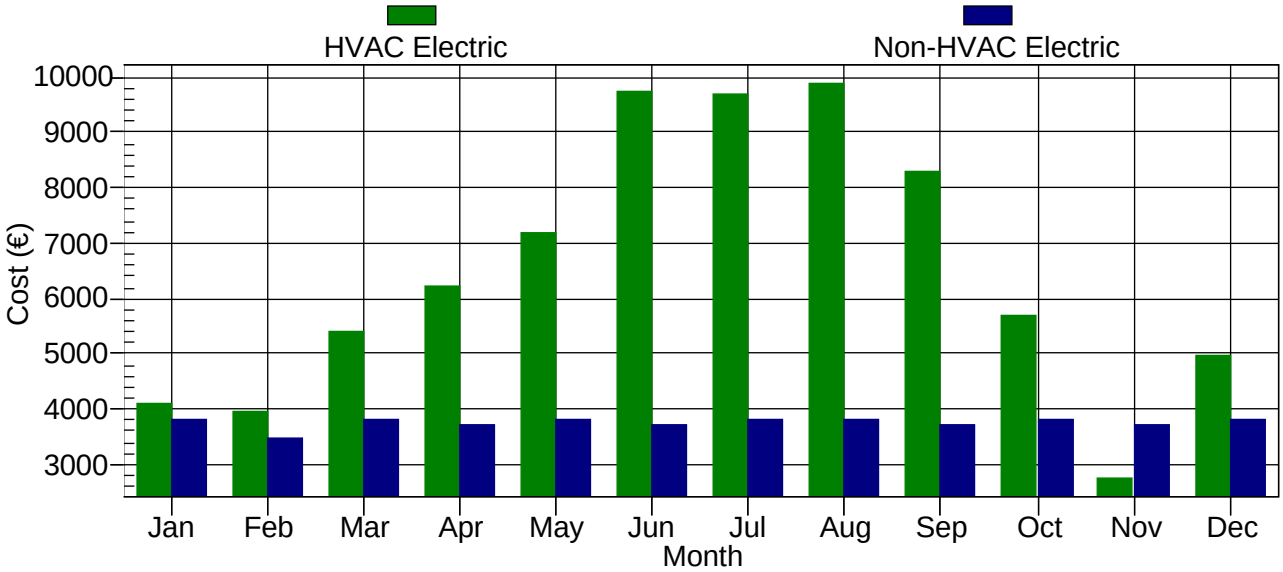


1. HVAC Component Costs

Month	Air System Fans (€)	Cooling (€)	Heating (€)	Pumps (€)	Heat Rejection Fans (€)	HVAC Total (€)
January	948	804	2 326	3	0	4 081
February	858	860	2 206	2	0	3 926
March	953	1 510	2 915	2	0	5 380
April	925	2 301	2 951	2	0	6 179
May	962	4 228	1 931	2	0	7 123
June	940	5 615	3 146	2	0	9 703
July	974	6 564	2 098	2	0	9 638
August	975	6 267	2 586	2	0	9 830
September	939	4 845	2 484	2	0	8 270
October	962	3 184	1 489	2	0	5 637
November	923	1 435	353	2	0	2 713
December	949	876	3 118	3	0	4 946
Total	**11 308**	**38 490**	**27 603**	**27**	**0**	**77 428**

2. Non-HVAC Component Costs

Month	Lights (€)	Electric Equipment (€)	Misc. Electric (€)	Misc. Fuel Use (€)	Non-HVAC Total (€)	Grand Total (€)
January	494	3 155	145	0	3 793	7 874
February	446	2 849	131	0	3 426	7 352
March	494	3 155	145	0	3 793	9 173
April	478	3 053	140	0	3 671	9 850
May	494	3 155	145	0	3 793	10 916
June	478	3 053	140	0	3 671	13 374
July	494	3 155	145	0	3 793	13 431
August	494	3 155	145	0	3 793	13 623
September	478	3 053	140	0	3 671	11 941
October	494	3 155	145	0	3 793	9 430
November	478	3 053	140	0	3 671	6 384
December	494	3 155	145	0	3 793	8 739
Total	**5 815**	**37 144**	**1 703**	**0**	**44 662**	**122 090**



1. HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)	Remote Chilled Water (€)
January	4 080	0	0	0	0	0	0
February	3 926	0	0	0	0	0	0
March	5 379	0	0	0	0	0	0
April	6 179	0	0	0	0	0	0
May	7 124	0	0	0	0	0	0
June	9 703	0	0	0	0	0	0
July	9 638	0	0	0	0	0	0
August	9 831	0	0	0	0	0	0
September	8 269	0	0	0	0	0	0
October	5 638	0	0	0	0	0	0
November	2 713	0	0	0	0	0	0
December	4 946	0	0	0	0	0	0
Total	**77 427**	**0**	**0**	**0**	**0**	**0**	**0**

2. Non-HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)
January	3 793	0	0	0	0	0
February	3 426	0	0	0	0	0
March	3 793	0	0	0	0	0
April	3 671	0	0	0	0	0
May	3 793	0	0	0	0	0
June	3 671	0	0	0	0	0
July	3 793	0	0	0	0	0
August	3 793	0	0	0	0	0
September	3 671	0	0	0	0	0
October	3 793	0	0	0	0	0
November	3 671	0	0	0	0	0
December	3 793	0	0	0	0	0
Total	**44 661**	**0**	**0**	**0**	**0**	**0**

Monthly Energy Use by Component - IPS - Control Building

Project: Anexo I - Calculations
Prepared by: IPS

11-04-2025
08:55

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	13167	11911	13231	12853	13367	13061	13523	13547	13036	13365	12814	13185
Cooling												
Electric (kWh)	11163	11946	20974	31959	58729	77989	91160	87038	67294	44226	19933	12173
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	32309	30645	40482	40986	26819	43688	29144	35922	34498	20684	4897	43302
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	36	31	32	28	30	28	30	29	28	30	33	36
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	6859	6195	6859	6638	6859	6638	6859	6859	6638	6859	6638	6859
Electric Eqpt. (kWh)	43815	39575	43815	42402	43815	42402	43815	43815	42402	43815	42402	43815
Misc. Electric (kWh)	2009	1814	2009	1944	2009	1944	2009	2009	1944	2009	1944	2009
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Energy Use by Energy Type - IPS - Control Building

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	56 673	0	0	0	0	0	0
Feb	54 531	0	0	0	0	0	0
Mar	74 711	0	0	0	0	0	0
Apr	85 826	0	0	0	0	0	0
May	98 942	0	0	0	0	0	0
Jun	134 768	0	0	0	0	0	0
Jul	133 858	0	0	0	0	0	0
Aug	136 539	0	0	0	0	0	0
Sep	114 854	0	0	0	0	0	0
Oct	78 303	0	0	0	0	0	0
Nov	37 677	0	0	0	0	0	0
Dec	68 690	0	0	0	0	0	0
Totals	1 075 372	0	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	52 682	0	0	0	0	0
Feb	47 584	0	0	0	0	0
Mar	52 682	0	0	0	0	0
Apr	50 983	0	0	0	0	0
May	52 682	0	0	0	0	0
Jun	50 983	0	0	0	0	0
Jul	52 682	0	0	0	0	0
Aug	52 682	0	0	0	0	0
Sep	50 983	0	0	0	0	0
Oct	52 682	0	0	0	0	0
Nov	50 983	0	0	0	0	0
Dec	52 682	0	0	0	0	0
Totals	620 293	0	0	0	0	0

Billing Details - Electric - IPS - Control Building

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Component Charges

Billing Period	Energy Charges (€)	Demand Charges (€)	Customer Charges (€)	Taxes (€)	Total Charge (€)
Jan	7 874	0	0	0	7 874
Feb	7 353	0	0	0	7 353
Mar	9 173	0	0	0	9 173
Apr	9 850	0	0	0	9 850
May	10 917	0	0	0	10 917
Jun	13 374	0	0	0	13 374
Jul	13 431	0	0	0	13 431
Aug	13 624	0	0	0	13 624
Sep	11 940	0	0	0	11 940
Oct	9 431	0	0	0	9 431
Nov	6 384	0	0	0	6 384
Dec	8 739	0	0	0	8 739
Totals	122 090	0	0	0	122 090

2. Totals

Billing Period	Total Charges (€)	Total Consumption (kWh)	Avg Price (€/kWh)
Jan	7 874	109 359	0,0720
Feb	7 353	102 118	0,0720
Mar	9 173	127 402	0,0720
Apr	9 850	136 811	0,0720
May	10 917	151 627	0,0720
Jun	13 374	185 749	0,0720
Jul	13 431	186 540	0,0720
Aug	13 624	189 219	0,0720
Sep	11 940	165 840	0,0720
Oct	9 431	130 988	0,0720
Nov	6 384	88 661	0,0720
Dec	8 739	121 379	0,0720
Totals	122 090	1 695 693	0,0720

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	109 359
Feb	0	0	0	0	102 118
Mar	0	0	0	0	127 402
Apr	0	0	0	0	136 811
May	0	0	0	0	151 627
Jun	0	0	0	0	185 749
Jul	0	0	0	0	186 540
Aug	0	0	0	0	189 219
Sep	0	0	0	0	165 840
Oct	0	0	0	0	130 988
Nov	0	0	0	0	88 661
Dec	0	0	0	0	121 379
Totals	0	0	0	0	1 695 693

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	209,9
Feb	0,0	0,0	0,0	0,0	207,4
Mar	0,0	0,0	0,0	0,0	254,7
Apr	0,0	0,0	0,0	0,0	268,2
May	0,0	0,0	0,0	0,0	326,1
Jun	0,0	0,0	0,0	0,0	348,1
Jul	0,0	0,0	0,0	0,0	364,6
Aug	0,0	0,0	0,0	0,0	356,9
Sep	0,0	0,0	0,0	0,0	322,1
Oct	0,0	0,0	0,0	0,0	285,4
Nov	0,0	0,0	0,0	0,0	209,9
Dec	0,0	0,0	0,0	0,0	206,6

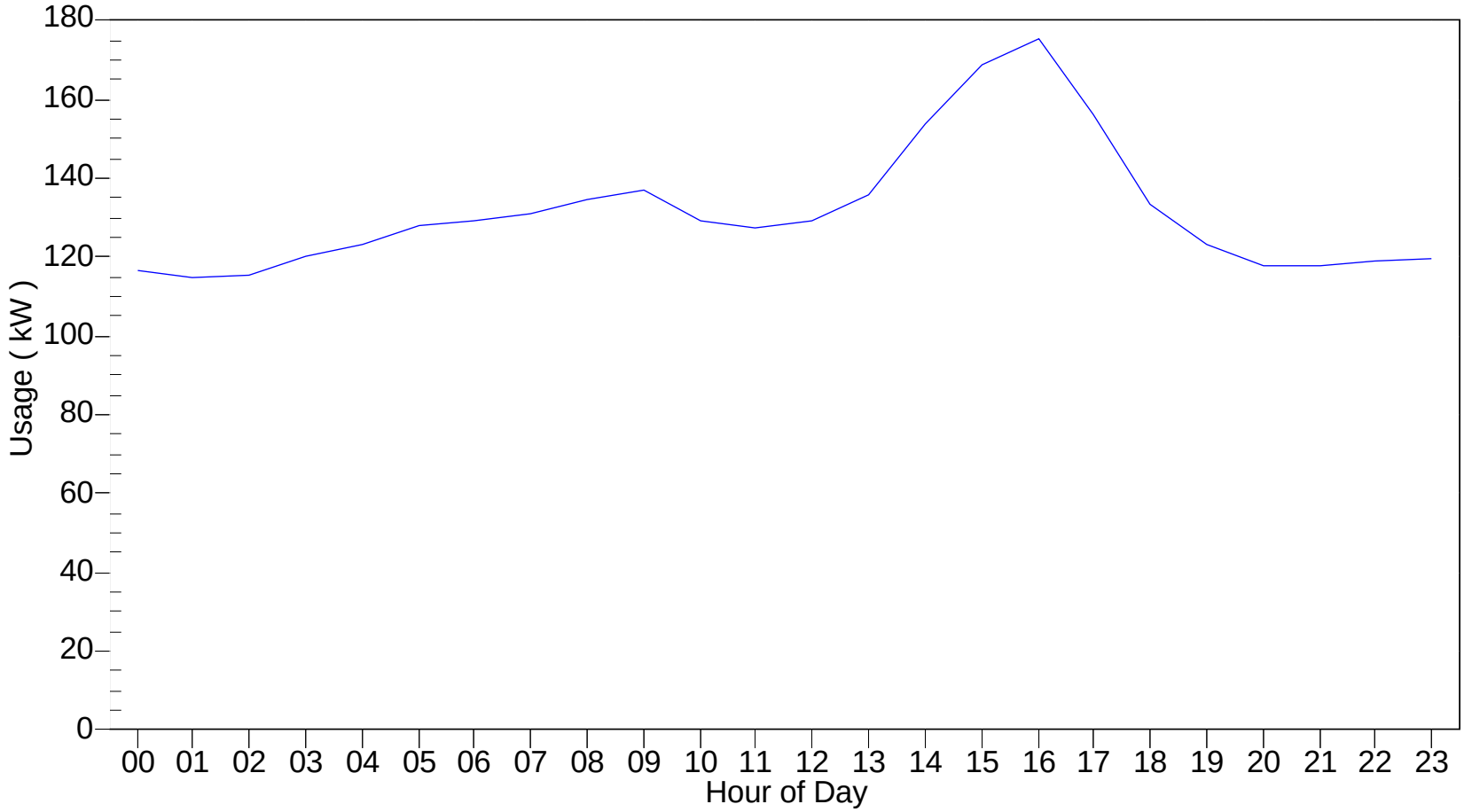
5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	209,9
Feb	0,0	0,0	0,0	0,0	207,4
Mar	0,0	0,0	0,0	0,0	254,7
Apr	0,0	0,0	0,0	0,0	268,2
May	0,0	0,0	0,0	0,0	326,1
Jun	0,0	0,0	0,0	0,0	348,1
Jul	0,0	0,0	0,0	0,0	364,6
Aug	0,0	0,0	0,0	0,0	356,9
Sep	0,0	0,0	0,0	0,0	322,1
Oct	0,0	0,0	0,0	0,0	285,4
Nov	0,0	0,0	0,0	0,0	209,9
Dec	0,0	0,0	0,0	0,0	206,6

6. Time Of Maximum Demands (Date/Hour)

Billing Period	Peak	Mid-Peak	Normal Peak	Off-Peak	Overall
Jan	n/a	n/a	n/a	n/a	1/13 08:00
Feb	n/a	n/a	n/a	n/a	2/10 14:00
Mar	n/a	n/a	n/a	n/a	3/16 15:00
Apr	n/a	n/a	n/a	n/a	4/17 14:00
May	n/a	n/a	n/a	n/a	5/29 14:00
Jun	n/a	n/a	n/a	n/a	6/19 14:00
Jul	n/a	n/a	n/a	n/a	7/16 16:00
Aug	n/a	n/a	n/a	n/a	8/4 16:00
Sep	n/a	n/a	n/a	n/a	9/5 15:00
Oct	n/a	n/a	n/a	n/a	10/6 14:00
Nov	n/a	n/a	n/a	n/a	11/8 13:00
Dec	n/a	n/a	n/a	n/a	12/27 06:00

Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)



Monthly Simulation Results for IPS - Chiller

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Plant Simulation Results (Table 1) :

Month	Cooling Coil Load (kWh)	Plant Cooling Load (kWh)	Chiller Output (kWh)	Chiller Input (kWh)	Primary Water Dist. Pump (kWh)
January	34670	34697	34697	11163	29
February	35837	35862	35862	11946	26
March	57503	57530	57530	20974	29
April	81956	81983	81983	31959	28
May	137700	137727	137727	58729	29
June	167141	167167	167167	77989	28
July	196175	196202	196202	91160	29
August	182553	182580	182580	87038	29
September	150483	150509	150509	67294	28
October	110746	110773	110773	44226	29
November	58474	58501	58501	19933	28
December	37843	37870	37870	12173	29
Total	**1251080**	**1251399**	**1251399**	**534584**	**340**

Unmet Load Report for IPS - Chiller

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025

Prepared by: IPS 08:55

Note: Data shown in this report is for diagnostic purposes only. Values represent total unmet hours for this plant. No deductions are made when unmet hours for this plant coincide with those in another plant or system in the building.

1. Unmet Cooling Load Statistics

Month	Equipment Capacity is Sufficient (hrs)	Capacity Insufficient by 0%-5% (hrs)	Capacity Insufficient by 5%-10% (hrs)	Capacity Insufficient by >10% (hrs)	Total Hours with Unmet Loads	Total Hours with Equipment Loads
January	744	0	0	0	0	744
February	672	0	0	0	0	672
March	744	0	0	0	0	744
April	720	0	0	0	0	720
May	744	0	0	0	0	744
June	720	0	0	0	0	720
July	744	0	0	0	0	744
August	744	0	0	0	0	744
September	720	0	0	0	0	720
October	744	0	0	0	0	744
November	720	0	0	0	0	720
December	744	0	0	0	0	744
Total	**8760**	**0**	**0**	**0**	**0**	**8760**

Monthly Simulation Results for IPS - Heat Pump

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025

Prepared by: IPS 08:55

Plant Simulation Results (Table 1) :

Month	Heating Coil Load (kWh)	Plant Heating Load (kWh)	Heat Pump Output (kWh)	Heat Pump Input (kWh)	Primary Water Dist. Pump (kWh)
January	25238	25231	25231	6580	7
February	9783	9778	9778	2597	5
March	4179	4177	4177	1116	3
April	288	287	287	75	0
May	1353	1353	1353	339	1
June	0	0	0	0	0
July	1213	1212	1212	284	1
August	16	16	16	4	0
September	0	0	0	0	0
October	973	972	972	239	1
November	6913	6909	6909	1832	5
December	28753	28747	28747	7475	7
Total	**78708**	**78681**	**78681**	**20541**	**29**

Unmet Load Report for IPS - Heat Pump
(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Note: Data shown in this report is for diagnostic purposes only. Values represent total unmet hours for this plant. No deductions are made when unmet hours for this plant coincide with those in another plant or system in the building.

1. Unmet Heating Load Statistics

Month	Equipment Capacity is Sufficient (hrs)	Capacity Insufficient by 0%-5% (hrs)	Capacity Insufficient by 5%-10% (hrs)	Capacity Insufficient by >10% (hrs)	Total Hours with Unmet Loads	Total Hours with Equipment Loads
January	677	0	0	0	0	677
February	452	0	0	0	0	452
March	256	0	0	0	0	256
April	42	0	0	0	0	42
May	82	0	0	0	0	82
June	0	0	0	0	0	0
July	87	0	0	0	0	87
August	2	0	0	0	0	2
September	0	0	0	0	0	0
October	87	0	0	0	0	87
November	453	0	0	0	0	453
December	644	0	0	0	0	644
Total	**2782**	**0**	**0**	**0**	**0**	**2782**

Monthly Simulation Results for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Terminal Heating Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)
January	357	9748	248	8182	128	14830	10691
February	324	4286	0	8353	3	16361	11794
March	3447	1824	26	11308	0	21971	15839
April	8172	68	67	13984	0	22831	16459
May	21481	0	665	16627	0	15308	11035
June	27394	0	0	18520	0	23962	17274
July	34809	0	599	19411	0	16595	11963
August	30422	0	8	19802	0	20472	14758
September	23243	0	0	18186	0	19656	14170
October	14379	35	438	16240	0	12351	8904
November	4877	1770	1514	10877	0	1993	1437
December	278	10738	108	9151	42	19806	14278
Total	**169183**	**28469**	**3672**	**170641**	**173**	**206136**	**148602**

Air System Simulation Results (Table 2) :

Month	Ventilation Fan (kWh)	Exhaust Fan (kWh)	Terminal Fan (kWh)	Air-to-Air Energy Recovery (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	3034	698	55	670	2185	5508
February	2740	630	55	605	1974	4975
March	3034	698	80	670	2185	5508
April	2936	676	95	648	2114	5331
May	3034	698	129	670	2185	5508
June	2936	676	198	648	2114	5331
July	3034	698	209	670	2185	5508
August	3034	698	222	670	2185	5508
September	2936	676	184	648	2114	5331
October	3034	698	124	670	2185	5508
November	2936	676	75	648	2114	5331
December	3034	698	65	670	2185	5508
Total	**35722**	**8219**	**1491**	**7884**	**25726**	**64857**

Zone Temperature Report for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.1.01 Corridor (0)	25,6	0	0	26,4	8760	20,2	0	0	21,2	na	na	na	na
0.1.02 Lobby (North)	26,9	0	0	26,4	8760	20,2	0	0	20,7	na	na	na	na
0.1.03 Lobby (West)	26,0	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.04 Corridor (SW)	25,9	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.05 Corridor (SE)	25,8	0	0	26,4	8760	20,2	0	0	22,9	na	na	na	na
0.1.06 Washroom (Senior Office)	25,1	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.07 Toilets M	25,5	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.08 Toilets F	25,8	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.09 Dinning Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.10 Kitchen / Tea Prep (0)	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
0.1.11 Pantry (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.12 Prayer Room F	24,5	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.13 Muster Room	24,3	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.14 Senior Office	24,2	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.15 Office 1	24,2	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.16 Meeting Room (0)	24,0	0	0	24,8	8760	20,2	0	0	21,1	na	na	na	na
0.1.17 Storage (East)	26,5	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.18 Storage (West)	26,0	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.19 Storage (Stairs)	26,5	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.20 Senior Store	26,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.21 Telecom Room	20,4	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na
0.1.22 HVAC Room (0)	25,9	0	0	26,4	8760	4,2	0	0	20,3	na	na	na	na
0.1.23 GSM Room	20,3	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Terminal Heating Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)
January	368	10807	256	122	10	15663	11292
February	337	4814	0	1073	0	17290	12465
March	3662	2064	26	3543	0	23061	16625
April	8721	82	70	7010	0	24103	17376
May	23044	0	688	9776	0	16547	11928
June	29543	0	0	12484	0	25528	18403
July	37446	0	615	12972	0	17747	12794
August	32828	0	8	13511	0	22090	15924
September	25046	0	0	11779	0	21322	15371
October	15368	43	456	8792	0	13301	9588
November	5070	2046	1565	2429	0	2132	1537
December	287	11975	111	585	10	21017	15151
Total	**181721**	**31833**	**3795**	**84074**	**19**	**219801**	**158453**

Air System Simulation Results (Table 2) :

Month	Ventilation Fan (kWh)	Exhaust Fan (kWh)	Terminal Fan (kWh)	Air-to-Air Energy Recovery (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	3120	586	39	670	3170	928
February	2818	530	35	605	2863	839
March	3120	586	39	670	3170	928
April	3019	568	38	648	3068	898
May	3120	586	51	670	3170	928
June	3019	568	95	648	3068	898
July	3120	586	98	670	3170	928
August	3120	586	112	670	3170	928
September	3019	568	79	648	3068	898
October	3120	586	45	670	3170	928
November	3019	568	38	648	3068	898
December	3120	586	39	670	3170	928
Total	**36730**	**6905**	**708**	**7884**	**37326**	**10931**

Zone Temperature Report for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.1.01 Corridor (1)	26,1	0	0	26,4	8760	20,2	0	0	21,5	na	na	na	na
1.1.02 Lobby (Control Room)	26,1	0	0	26,4	8760	20,2	0	0	20,8	na	na	na	na
1.1.03 Toilets M	25,6	0	0	26,4	8760	20,2	0	0	20,8	na	na	na	na
1.1.04 Prayer Room M	24,0	0	0	24,8	8760	20,2	0	0	21,8	na	na	na	na
1.1.05 Meeting Room (1)	24,0	0	0	24,8	8760	20,2	0	0	21,8	na	na	na	na
1.1.06 Office 2	24,0	0	0	24,8	8760	20,2	0	0	21,7	na	na	na	na
1.1.07 Office 3	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.08 Office 4	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.09 Office 5	24,0	0	0	24,8	8760	20,2	0	0	21,7	na	na	na	na
1.1.10 Kitchen / Tea Prep. (1)	24,0	0	0	24,8	8760	20,2	0	0	22,4	na	na	na	na
1.1.11 Pantry (1)	24,0	0	0	24,8	8760	20,2	0	0	21,1	na	na	na	na
1.1.12 Storage Room (1)	26,3	0	0	26,4	8760	20,2	0	0	21,1	na	na	na	na
1.1.13 Control Room Filing	25,3	0	0	26,4	8760	20,2	0	0	21,3	na	na	na	na
1.1.14 Control Room Training	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.15 Control Room	24,1	0	0	24,8	8760	20,2	0	0	22,6	na	na	na	na
1.1.16 Engineering Room	24,1	0	0	24,8	8760	20,2	0	0	21,2	na	na	na	na
1.1.17 HVAC Room (1)	25,9	0	0	26,4	8760	4,2	0	0	21,7	na	na	na	na
1.1.18 Corridor (2)	25,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Ventilation Fan (kWh)
January	3	4041	0	25639	5198	3747	4170
February	145	679	0	25605	5256	3789	3766
March	3534	240	0	32010	9575	6903	4170
April	9074	0	0	34995	9817	7077	4035
May	27821	0	0	38951	4877	3516	4170
June	39382	0	0	39817	11113	8011	4035
July	50057	0	0	41480	5690	4102	4170
August	44178	0	0	41812	7264	5236	4170
September	32469	0	0	39759	6876	4957	4035
October	17124	0	0	38843	2709	1953	4170
November	2955	18	0	32268	127	91	4035
December	54	5770	0	27488	8876	6398	4170
Total	**226796**	**10748**	**0**	**418665**	**77377**	**55781**	**49095**

Air System Simulation Results (Table 2) :

Month	Terminal Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	126	1504	37379
February	127	1359	33761
March	165	1504	37379
April	191	1456	36173
May	240	1504	37379
June	239	1456	36173
July	269	1504	37379
August	266	1504	37379
September	244	1456	36173
October	249	1504	37379
November	172	1456	36173
December	134	1504	37379
Total	**2420**	**17710**	**440102**

Zone Temperature Report for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - Control Building)

Project: Anexo I - Calculations 11-04-2025
Prepared by: IPS 08:55

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.2.01 Marshaling Room	26,0	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.02 Auxiliary Room	26,1	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.03 Server Room	26,3	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.04 UPS Room	26,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.05 Security Equipment Room	26,8	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.06 Battery Room	25,6	0	0	26,4	8760	4,2	0	0	14,9	na	na	na	na
1.2.07 Machine Room	25,6	0	0	26,4	8760	4,2	0	0	21,1	na	na	na	na
1.2.08 Water Tanks	25,7	0	0	26,4	8760	4,2	0	0	18,2	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Annual Cost Summary

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

Table 1. Annual Costs

Component	IPS - HR - Control Building (€)
Air System Fans	11 308
Cooling	40 553
Heating	27 739
Pumps	26
Heat Rejection Fans	0
HVAC Sub-Total	**79 626**
Lights	5 815
Electric Equipment	37 144
Misc. Electric	1 703
Misc. Fuel Use	0
Non-HVAC Sub-Total	**44 662**
Grand Total	**124 287**

Table 2. Annual Cost per Unit Floor Area

Component	IPS - HR - Control Building (€/sqm)
Air System Fans	3,801
Cooling	13,629
Heating	9,323
Pumps	0,009
Heat Rejection Fans	0,000
HVAC Sub-Total	**26,761**
Lights	1,954
Electric Equipment	12,484
Misc. Electric	0,572
Misc. Fuel Use	0,000
Non-HVAC Sub-Total	**15,010**
Grand Total	**41,772**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	IPS - HR - Control Building (%)
Air System Fans	9,1
Cooling	32,6
Heating	22,3
Pumps	0,0
Heat Rejection Fans	0,0
HVAC Sub-Total	**64,1**
Lights	4,7
Electric Equipment	29,9
Misc. Electric	1,4
Misc. Fuel Use	0,0
Non-HVAC Sub-Total	**35,9**
Grand Total	**100,0**

Table 1. Annual Costs

Component	IPS - HR - Control Building (€)
HVAC Components	
Electric	79 624
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**79 624**
Non-HVAC Components	
Electric	44 661
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**44 661**
Grand Total	**124 285**

Table 2. Annual Energy Consumption

Component	IPS - HR - Control Building
HVAC Components	
Electric (kWh)	1 105 894
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	620 293
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	1 726 187
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	IPS - HR - Control Building
CO2 Equivalent (kg)	621 439

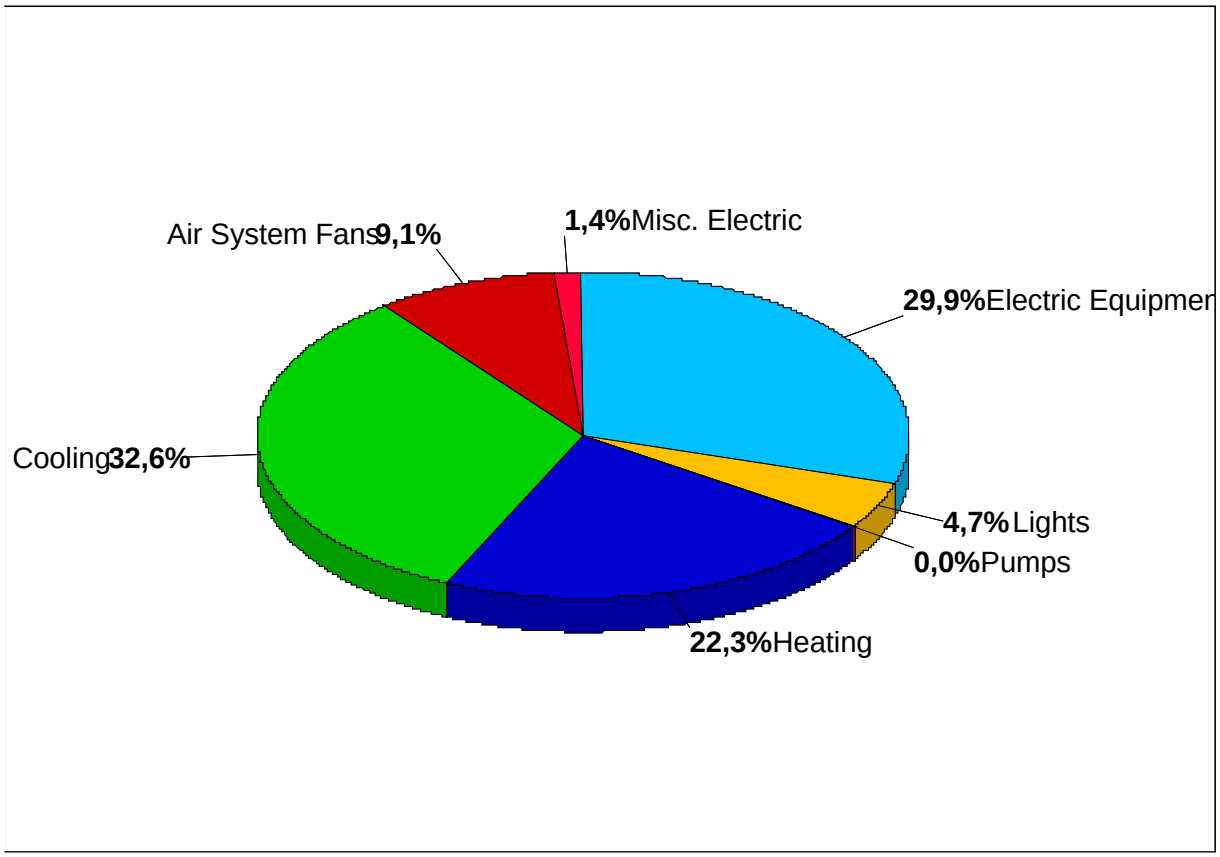
Table 4. Annual Cost per Unit Floor Area

Component	IPS - HR - Control Building (€/sqm)
HVAC Components	
Electric	26,761
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Remote CW	0,000
HVAC Sub-Total	**26,761**
Non-HVAC Components	
Electric	15,010
Natural Gas	0,000
Fuel Oil	0,000
Propane	0,000
Remote HW	0,000
Remote Steam	0,000
Non-HVAC Sub-Total	**15,010**
Grand Total	**41,771**
Gross Floor Area (sqm)	2975,4
Modeled Floor Area (sqm)	2975,4

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	IPS - HR - Control Building (%)
HVAC Components	
Electric	64,1
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Remote CW	0,0
HVAC Sub-Total	**64,1**
Non-HVAC Components	
Electric	35,9
Natural Gas	0,0
Fuel Oil	0,0
Propane	0,0
Remote HW	0,0
Remote Steam	0,0
Non-HVAC Sub-Total	**35,9**
Grand Total	**100,0**

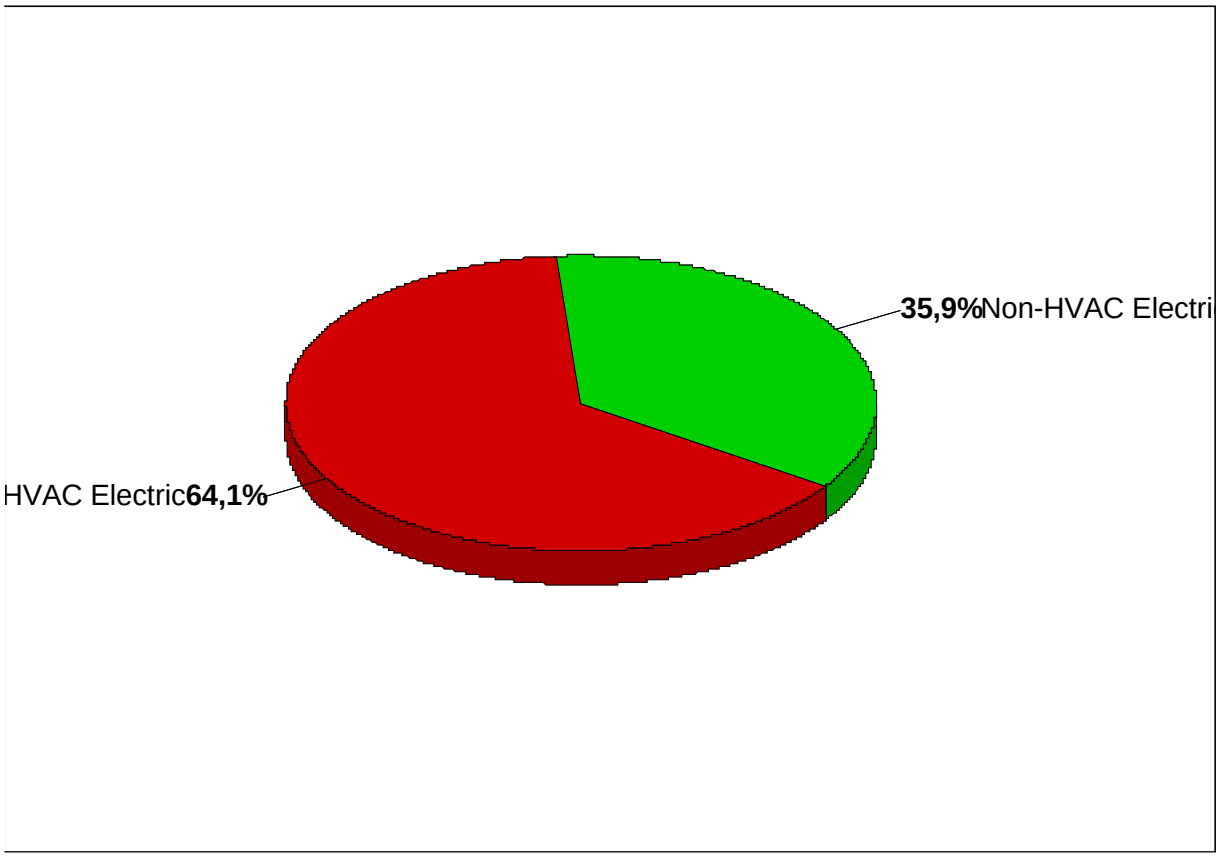


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
Air System Fans	11 308	3,801	9,1
Cooling	40 553	13,629	32,6
Heating	27 739	9,323	22,3
Pumps	26	0,009	0,0
Heat Rejection Fans	0	0,000	0,0
HVAC Sub-Total	**79 626**	**26,761**	**64,1**
Lights	5 815	1,954	4,7
Electric Equipment	37 144	12,484	29,9
Misc. Electric	1 703	0,572	1,4
Misc. Fuel Use	0	0,000	0,0
Non-HVAC Sub-Total	**44 662**	**15,010**	**35,9**
Grand Total	**124 287**	**41,772**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

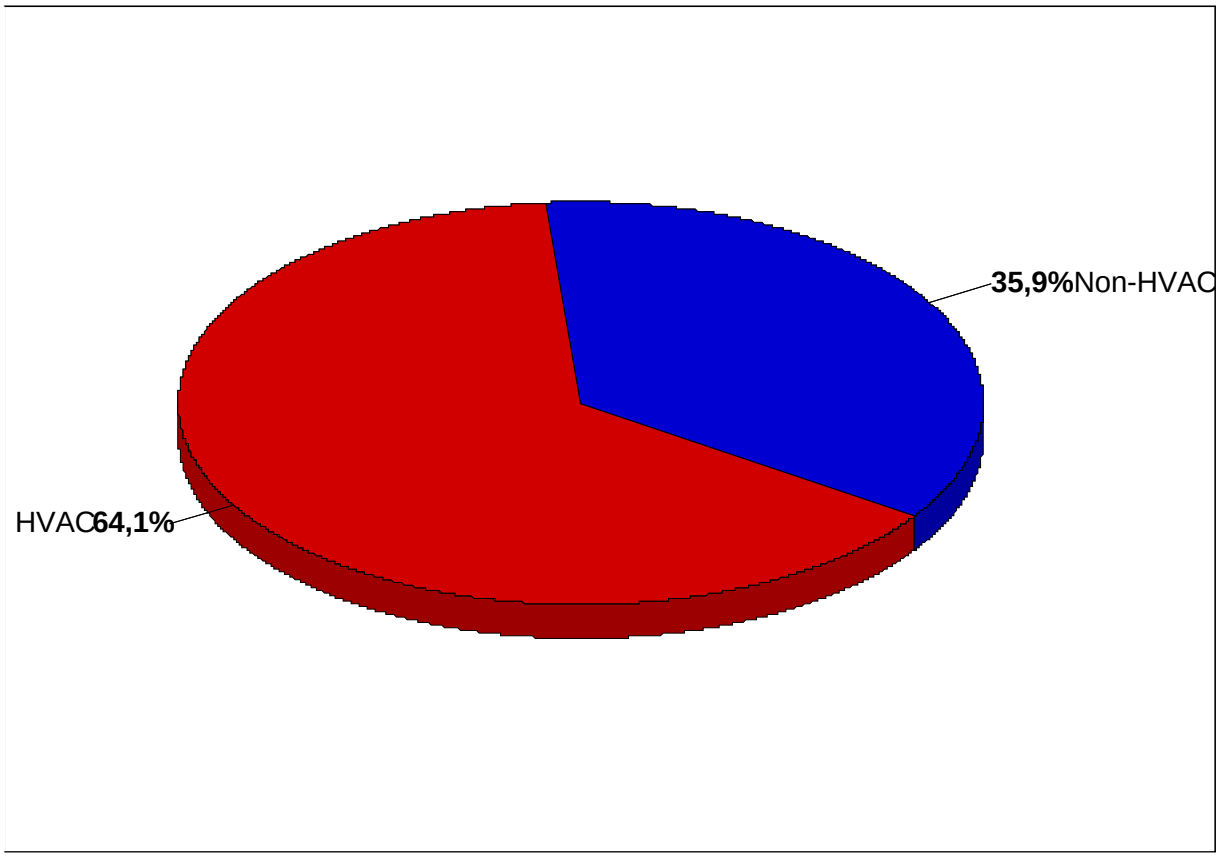


1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC Components			
Electric	79 624	26,761	64,1
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Remote Chilled Water	0	0,000	0,0
HVAC Sub-Total	**79 624**	**26,761**	**64,1**
Non-HVAC Components			
Electric	44 661	15,010	35,9
Natural Gas	0	0,000	0,0
Fuel Oil	0	0,000	0,0
Propane	0	0,000	0,0
Remote Hot Water	0	0,000	0,0
Remote Steam	0	0,000	0,0
Non-HVAC Sub-Total	**44 661**	**15,010**	**35,9**
Grand Total	**124 285**	**41,771**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm



1. Annual Costs

Component	Annual Cost (€)	(€/sqm)	Percent of Total (%)
HVAC	79 626	26,761	64,1
Non-HVAC	44 662	15,010	35,9
Grand Total	**124 287**	**41,772**	**100,0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2 975,4** sqm
Modeled Floor Area ..... **2 975,4** sqm

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

2. Energy Consumption by System Component

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
Air System Fans	157 059	52,786	392 647	131,964
Cooling	563 227	189,294	1 408 067	473,236
Heating	385 263	129,483	963 158	323,706
Pumps	358	0,120	894	0,300
Heat Rejection Fans	0	0,000	0	0,000
HVAC Sub-Total	**1 105 906**	**371,683**	**2 764 765**	**929,206**
Lights	80 760	27,143	201 900	67,856
Electric Equipment	515 885	173,383	1 289 712	433,458
Misc. Electric	23 652	7,949	59 129	19,873
Misc. Fuel Use	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 296**	**208,475**	**1 550 741**	**521,187**
Grand Total	**1 726 203**	**580,157**	**4 315 506**	**1450,393**

Notes:

1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **2975,4** sqm
Modeled Floor Area ..... **2975,4** sqm

1. Annual Coil Loads

Component	Load (kWh)	(kWh/sqm)
Cooling Coil Loads	1 251 080	420,474
Heating Coil Loads	421 723	141,736
Grand Total	**1 672 803**	**562,210**

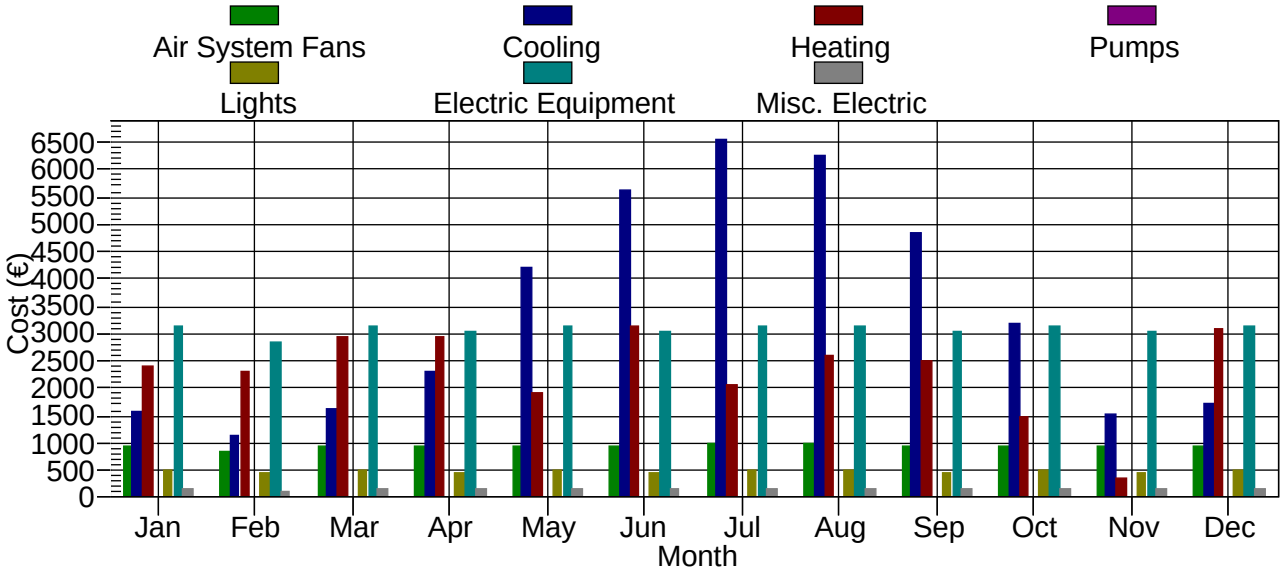
2. Energy Consumption by Energy Source

Component	Site Energy (kWh)	Site Energy (kWh/sqm)	Source Energy (kWh)	Source Energy (kWh/sqm)
HVAC Components				
Electric	1 105 888	371,676	2 764 720	929,191
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Remote Chilled Water	0	0,000	0	0,000
HVAC Sub-Total	**1 105 888**	**371,676**	**2 764 720**	**929,191**
Non-HVAC Components				
Electric	620 289	208,472	1 550 724	521,181
Natural Gas	0	0,000	0	0,000
Fuel Oil	0	0,000	0	0,000
Propane	0	0,000	0	0,000
Remote Hot Water	0	0,000	0	0,000
Remote Steam	0	0,000	0	0,000
Non-HVAC Sub-Total	**620 289**	**208,472**	**1 550 724**	**521,181**
Grand Total	**1 726 177**	**580,149**	**4 315 443**	**1450,372**

Notes:
1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (40,0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **2975,4** sqm
   Modeled Floor Area ..... **2975,4** sqm

Monthly Component Costs - IPS - HR - Control Building

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

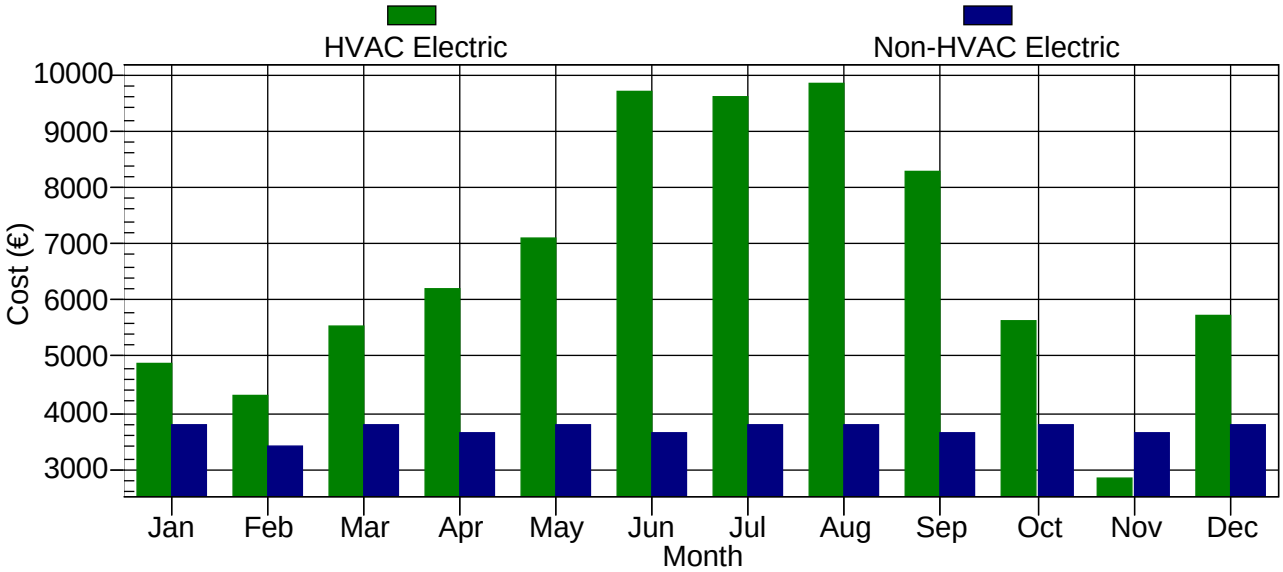


1. HVAC Component Costs

Month	Air System Fans (€)	Cooling (€)	Heating (€)	Pumps (€)	Heat Rejection Fans (€)	HVAC Total (€)
January	948	1 556	2 383	3	0	4 890
February	858	1 118	2 318	2	0	4 296
March	953	1 612	2 963	2	0	5 530
April	925	2 305	2 952	2	0	6 184
May	962	4 230	1 910	2	0	7 104
June	940	5 615	3 146	2	0	9 703
July	974	6 553	2 080	2	0	9 609
August	975	6 266	2 586	2	0	9 829
September	939	4 845	2 484	2	0	8 270
October	962	3 185	1 477	2	0	5 626
November	923	1 547	377	2	0	2 849
December	949	1 720	3 064	3	0	5 736
Total	**11 308**	**40 553**	**27 739**	**26**	**0**	**79 626**

2. Non-HVAC Component Costs

Month	Lights (€)	Electric Equipment (€)	Misc. Electric (€)	Misc. Fuel Use (€)	Non-HVAC Total (€)	Grand Total (€)
January	494	3 155	145	0	3 793	8 683
February	446	2 849	131	0	3 426	7 722
March	494	3 155	145	0	3 793	9 323
April	478	3 053	140	0	3 671	9 855
May	494	3 155	145	0	3 793	10 897
June	478	3 053	140	0	3 671	13 374
July	494	3 155	145	0	3 793	13 402
August	494	3 155	145	0	3 793	13 622
September	478	3 053	140	0	3 671	11 941
October	494	3 155	145	0	3 793	9 419
November	478	3 053	140	0	3 671	6 520
December	494	3 155	145	0	3 793	9 529
Total	**5 815**	**37 144**	**1 703**	**0**	**44 662**	**124 287**



1. HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)	Remote Chilled Water (€)
January	4 889	0	0	0	0	0	0
February	4 295	0	0	0	0	0	0
March	5 529	0	0	0	0	0	0
April	6 184	0	0	0	0	0	0
May	7 104	0	0	0	0	0	0
June	9 703	0	0	0	0	0	0
July	9 609	0	0	0	0	0	0
August	9 830	0	0	0	0	0	0
September	8 269	0	0	0	0	0	0
October	5 626	0	0	0	0	0	0
November	2 849	0	0	0	0	0	0
December	5 736	0	0	0	0	0	0
Total	**79 624**	**0**	**0**	**0**	**0**	**0**	**0**

2. Non-HVAC Costs

Month	Electric (€)	Natural Gas (€)	Fuel Oil (€)	Propane (€)	Remote Hot Water (€)	Remote Steam (€)
January	3 793	0	0	0	0	0
February	3 426	0	0	0	0	0
March	3 793	0	0	0	0	0
April	3 671	0	0	0	0	0
May	3 793	0	0	0	0	0
June	3 671	0	0	0	0	0
July	3 793	0	0	0	0	0
August	3 793	0	0	0	0	0
September	3 671	0	0	0	0	0
October	3 793	0	0	0	0	0
November	3 671	0	0	0	0	0
December	3 793	0	0	0	0	0
Total	**44 661**	**0**	**0**	**0**	**0**	**0**

Monthly Energy Use by Component - IPS - HR - Control Building

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	13167	11911	13231	12853	13367	13061	13523	13547	13036	13365	12814	13185
Cooling												
Electric (kWh)	21609	15526	22392	32017	58751	77988	91013	87035	67294	44238	21484	23882
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	33101	32189	41151	40994	26529	43688	28893	35919	34498	20511	5234	42559
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	37	31	31	27	28	26	28	27	26	28	33	37
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	6859	6195	6859	6638	6859	6638	6859	6859	6638	6859	6638	6859
Electric Eqpt. (kWh)	43815	39575	43815	42402	43815	42402	43815	43815	42402	43815	42402	43815
Misc. Electric (kWh)	2009	1814	2009	1944	2009	1944	2009	2009	1944	2009	1944	2009
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Energy Use by Energy Type - IPS - HR - Control Building

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	67 909	0	0	0	0	0	0
Feb	59 653	0	0	0	0	0	0
Mar	76 798	0	0	0	0	0	0
Apr	85 891	0	0	0	0	0	0
May	98 673	0	0	0	0	0	0
Jun	134 766	0	0	0	0	0	0
Jul	133 459	0	0	0	0	0	0
Aug	136 530	0	0	0	0	0	0
Sep	114 851	0	0	0	0	0	0
Oct	78 140	0	0	0	0	0	0
Nov	39 564	0	0	0	0	0	0
Dec	79 660	0	0	0	0	0	0
Totals	1 105 894	0	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	52 682	0	0	0	0	0
Feb	47 584	0	0	0	0	0
Mar	52 682	0	0	0	0	0
Apr	50 983	0	0	0	0	0
May	52 682	0	0	0	0	0
Jun	50 983	0	0	0	0	0
Jul	52 682	0	0	0	0	0
Aug	52 682	0	0	0	0	0
Sep	50 983	0	0	0	0	0
Oct	52 682	0	0	0	0	0
Nov	50 983	0	0	0	0	0
Dec	52 682	0	0	0	0	0
Totals	620 293	0	0	0	0	0

Billing Details - Electric - IPS - HR - Control Building

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

1. Component Charges

Billing Period	Energy Charges (€)	Demand Charges (€)	Customer Charges (€)	Taxes (€)	Total Charge (€)
Jan	8 683	0	0	0	8 683
Feb	7 721	0	0	0	7 721
Mar	9 323	0	0	0	9 323
Apr	9 855	0	0	0	9 855
May	10 898	0	0	0	10 898
Jun	13 374	0	0	0	13 374
Jul	13 402	0	0	0	13 402
Aug	13 623	0	0	0	13 623
Sep	11 940	0	0	0	11 940
Oct	9 419	0	0	0	9 419
Nov	6 520	0	0	0	6 520
Dec	9 529	0	0	0	9 529
Totals	124 288	0	0	0	124 288

2. Totals

Billing Period	Total Charges (€)	Total Consumption (kWh)	Avg Price (€/kWh)
Jan	8 683	120 598	0,0720
Feb	7 721	107 242	0,0720
Mar	9 323	129 488	0,0720
Apr	9 855	136 876	0,0720
May	10 898	151 358	0,0720
Jun	13 374	185 747	0,0720
Jul	13 402	186 141	0,0720
Aug	13 623	189 211	0,0720
Sep	11 940	165 837	0,0720
Oct	9 419	130 825	0,0720
Nov	6 520	90 549	0,0720
Dec	9 529	132 345	0,0720
Totals	124 288	1 726 218	0,0720

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	120 598
Feb	0	0	0	0	107 242
Mar	0	0	0	0	129 488
Apr	0	0	0	0	136 876
May	0	0	0	0	151 358
Jun	0	0	0	0	185 747
Jul	0	0	0	0	186 141
Aug	0	0	0	0	189 211
Sep	0	0	0	0	165 837
Oct	0	0	0	0	130 825
Nov	0	0	0	0	90 549
Dec	0	0	0	0	132 345
Totals	0	0	0	0	1 726 218

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	244,5
Feb	0,0	0,0	0,0	0,0	215,3
Mar	0,0	0,0	0,0	0,0	254,6
Apr	0,0	0,0	0,0	0,0	268,2
May	0,0	0,0	0,0	0,0	326,1
Jun	0,0	0,0	0,0	0,0	348,1
Jul	0,0	0,0	0,0	0,0	364,6
Aug	0,0	0,0	0,0	0,0	356,9
Sep	0,0	0,0	0,0	0,0	322,1
Oct	0,0	0,0	0,0	0,0	285,4
Nov	0,0	0,0	0,0	0,0	209,9
Dec	0,0	0,0	0,0	0,0	236,9

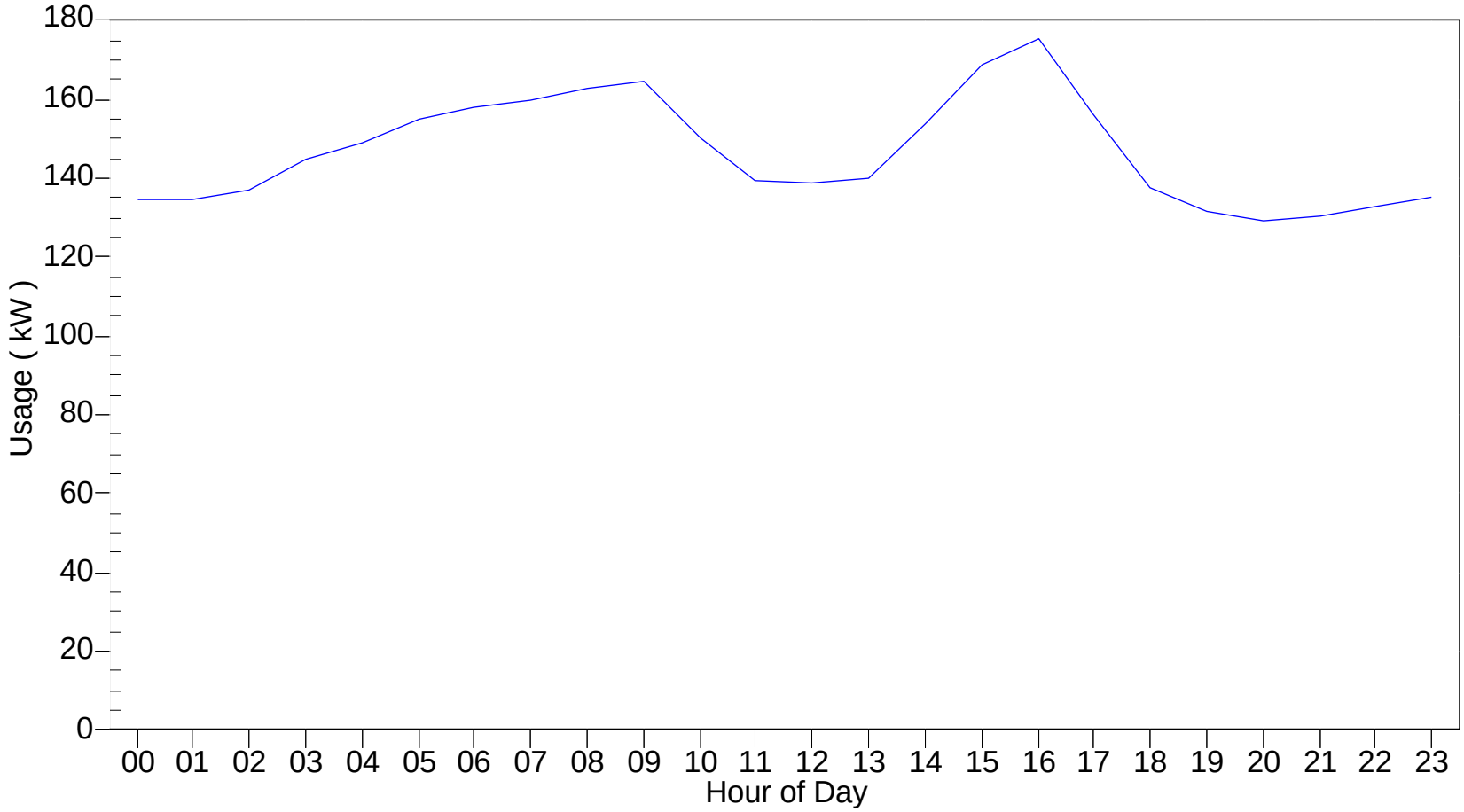
5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0,0	0,0	0,0	0,0	244,5
Feb	0,0	0,0	0,0	0,0	215,3
Mar	0,0	0,0	0,0	0,0	254,6
Apr	0,0	0,0	0,0	0,0	268,2
May	0,0	0,0	0,0	0,0	326,1
Jun	0,0	0,0	0,0	0,0	348,1
Jul	0,0	0,0	0,0	0,0	364,6
Aug	0,0	0,0	0,0	0,0	356,9
Sep	0,0	0,0	0,0	0,0	322,1
Oct	0,0	0,0	0,0	0,0	285,4
Nov	0,0	0,0	0,0	0,0	209,9
Dec	0,0	0,0	0,0	0,0	236,9

6. Time Of Maximum Demands (Date/Hour)

Billing Period	Peak	Mid-Peak	Normal Peak	Off-Peak	Overall
Jan	n/a	n/a	n/a	n/a	1/13 08:00
Feb	n/a	n/a	n/a	n/a	2/15 07:00
Mar	n/a	n/a	n/a	n/a	3/16 15:00
Apr	n/a	n/a	n/a	n/a	4/17 14:00
May	n/a	n/a	n/a	n/a	5/29 14:00
Jun	n/a	n/a	n/a	n/a	6/19 14:00
Jul	n/a	n/a	n/a	n/a	7/16 16:00
Aug	n/a	n/a	n/a	n/a	8/4 16:00
Sep	n/a	n/a	n/a	n/a	9/5 15:00
Oct	n/a	n/a	n/a	n/a	10/6 14:00
Nov	n/a	n/a	n/a	n/a	11/8 13:00
Dec	n/a	n/a	n/a	n/a	12/27 06:00

Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)



Monthly Simulation Results for IPS - HR Chiller

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

Plant Simulation Results (Table 1) :

Month	Cooling Coil Load (kWh)	Heating Coil Load (kWh)	Plant Cooling Load (kWh)	Plant Heating Load (kWh)	Chiller Output (kWh)	Heat Recovered (kWh)	Boiler Output (kWh)
January	34670	25238	34695	7372	39524	17856	7372
February	35837	9783	35860	4141	38622	5635	4141
March	57503	4179	57528	1785	58620	2390	1785
April	81956	288	81981	83	82020	204	83
May	137700	1353	137725	49	137726	1303	49
June	167141	0	167165	0	167165	0	0
July	196175	1213	196200	34	196200	1178	34
August	182553	16	182578	0	182578	15	0
September	150483	0	150507	0	150507	0	0
October	110746	973	110771	66	110791	906	66
November	58474	6913	58499	2169	59587	4737	2169
December	37843	28753	37868	6732	41749	22012	6732
Total	**1251080**	**78708**	**1251376**	**22431**	**1265089**	**56237**	**22431**

Plant Simulation Results (Table 2) :

Month	Chiller Input (kWh)	Boiler Input - Electric (kWh)	Boiler Misc. Electric (kWh)	Primary Water Dist. Pump (kWh)
January	21609	7372	0	37
February	15526	4141	0	31
March	22392	1785	0	31
April	32017	83	0	27
May	58751	49	0	28
June	77988	0	0	26
July	91013	34	0	28
August	87035	0	0	27
September	67294	0	0	26
October	44238	66	0	28
November	21484	2169	0	33
December	23882	6732	0	37
Total	**563230**	**22431**	**0**	**358**

Monthly Simulation Results for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025

Prepared by: IPS 17:25

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Terminal Heating Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)
January	357	9748	248	8182	128	14830	10691
February	324	4286	0	8353	3	16361	11794
March	3447	1824	26	11308	0	21971	15839
April	8172	68	67	13984	0	22831	16459
May	21481	0	665	16627	0	15308	11035
June	27394	0	0	18520	0	23962	17274
July	34809	0	599	19411	0	16595	11963
August	30422	0	8	19802	0	20472	14758
September	23243	0	0	18186	0	19656	14170
October	14379	35	438	16240	0	12351	8904
November	4877	1770	1514	10877	0	1993	1437
December	278	10738	108	9151	42	19806	14278
Total	**169183**	**28469**	**3672**	**170641**	**173**	**206136**	**148602**

Air System Simulation Results (Table 2) :

Month	Ventilation Fan (kWh)	Exhaust Fan (kWh)	Terminal Fan (kWh)	Air-to-Air Energy Recovery (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	3034	698	55	670	2185	5508
February	2740	630	55	605	1974	4975
March	3034	698	80	670	2185	5508
April	2936	676	95	648	2114	5331
May	3034	698	129	670	2185	5508
June	2936	676	198	648	2114	5331
July	3034	698	209	670	2185	5508
August	3034	698	222	670	2185	5508
September	2936	676	184	648	2114	5331
October	3034	698	124	670	2185	5508
November	2936	676	75	648	2114	5331
December	3034	698	65	670	2185	5508
Total	**35722**	**8219**	**1491**	**7884**	**25726**	**64857**

Zone Temperature Report for IPS - Control Building - FAHU 0.1 (Offices 0)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
0.1.01 Corridor (0)	25,6	0	0	26,4	8760	20,2	0	0	21,2	na	na	na	na
0.1.02 Lobby (North)	26,9	0	0	26,4	8760	20,2	0	0	20,7	na	na	na	na
0.1.03 Lobby (West)	26,0	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.04 Corridor (SW)	25,9	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.05 Corridor (SE)	25,8	0	0	26,4	8760	20,2	0	0	22,9	na	na	na	na
0.1.06 Washroom (Senior Office)	25,1	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.07 Toilets M	25,5	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.08 Toilets F	25,8	0	0	26,4	8760	20,2	0	0	20,9	na	na	na	na
0.1.09 Dinning Room	24,1	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.10 Kitchen / Tea Prep (0)	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
0.1.11 Pantry (0)	24,0	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.12 Prayer Room F	24,5	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.13 Muster Room	24,3	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.14 Senior Office	24,2	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.15 Office 1	24,2	0	0	24,8	8760	20,2	0	0	21,0	na	na	na	na
0.1.16 Meeting Room (0)	24,0	0	0	24,8	8760	20,2	0	0	21,1	na	na	na	na
0.1.17 Storage (East)	26,5	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.18 Storage (West)	26,0	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.19 Storage (Stairs)	26,5	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.20 Senior Store	26,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na
0.1.21 Telecom Room	20,4	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na
0.1.22 HVAC Room (0)	25,9	0	0	26,4	8760	4,2	0	0	20,3	na	na	na	na
0.1.23 GSM Room	20,3	0	0	20,8	8760	15,2	0	0	20,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Terminal Heating Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)
January	368	10807	256	122	10	15663	11292
February	337	4814	0	1073	0	17290	12465
March	3662	2064	26	3543	0	23061	16625
April	8721	82	70	7010	0	24103	17376
May	23044	0	688	9776	0	16547	11928
June	29543	0	0	12484	0	25528	18403
July	37446	0	615	12972	0	17747	12794
August	32828	0	8	13511	0	22090	15924
September	25046	0	0	11779	0	21322	15371
October	15368	43	456	8792	0	13301	9588
November	5070	2046	1565	2429	0	2132	1537
December	287	11975	111	585	10	21017	15151
Total	**181721**	**31833**	**3795**	**84074**	**19**	**219801**	**158453**

Air System Simulation Results (Table 2) :

Month	Ventilation Fan (kWh)	Exhaust Fan (kWh)	Terminal Fan (kWh)	Air-to-Air Energy Recovery (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	3120	586	39	670	3170	928
February	2818	530	35	605	2863	839
March	3120	586	39	670	3170	928
April	3019	568	38	648	3068	898
May	3120	586	51	670	3170	928
June	3019	568	95	648	3068	898
July	3120	586	98	670	3170	928
August	3120	586	112	670	3170	928
September	3019	568	79	648	3068	898
October	3120	586	45	670	3170	928
November	3019	568	38	648	3068	898
December	3120	586	39	670	3170	928
Total	**36730**	**6905**	**708**	**7884**	**37326**	**10931**

Zone Temperature Report for IPS - Control Building - FAHU 1.1 (Offices 1)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.1.01 Corridor (1)	26,1	0	0	26,4	8760	20,2	0	0	21,5	na	na	na	na
1.1.02 Lobby (Control Room)	26,1	0	0	26,4	8760	20,2	0	0	20,8	na	na	na	na
1.1.03 Toilets M	25,6	0	0	26,4	8760	20,2	0	0	20,8	na	na	na	na
1.1.04 Prayer Room M	24,0	0	0	24,8	8760	20,2	0	0	21,8	na	na	na	na
1.1.05 Meeting Room (1)	24,0	0	0	24,8	8760	20,2	0	0	21,8	na	na	na	na
1.1.06 Office 2	24,0	0	0	24,8	8760	20,2	0	0	21,7	na	na	na	na
1.1.07 Office 3	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.08 Office 4	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.09 Office 5	24,0	0	0	24,8	8760	20,2	0	0	21,7	na	na	na	na
1.1.10 Kitchen / Tea Prep. (1)	24,0	0	0	24,8	8760	20,2	0	0	22,4	na	na	na	na
1.1.11 Pantry (1)	24,0	0	0	24,8	8760	20,2	0	0	21,1	na	na	na	na
1.1.12 Storage Room (1)	26,3	0	0	26,4	8760	20,2	0	0	21,1	na	na	na	na
1.1.13 Control Room Filing	25,3	0	0	26,4	8760	20,2	0	0	21,3	na	na	na	na
1.1.14 Control Room Training	24,0	0	0	24,8	8760	20,2	0	0	21,6	na	na	na	na
1.1.15 Control Room	24,1	0	0	24,8	8760	20,2	0	0	22,6	na	na	na	na
1.1.16 Engineering Room	24,1	0	0	24,8	8760	20,2	0	0	21,2	na	na	na	na
1.1.17 HVAC Room (1)	25,9	0	0	26,4	8760	4,2	0	0	21,7	na	na	na	na
1.1.18 Corridor (2)	25,6	0	0	26,4	8760	20,2	0	0	21,0	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Monthly Simulation Results for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025
Prepared by: IPS 17:25

Air System Simulation Results (Table 1) :

Month	Precool Coil Load (kWh)	Preheat Coil Load (kWh)	Dehumid. Reheat Coil Load (kWh)	Terminal Cooling Coil Load (kWh)	Humidifier Load (kg)	Humidifier Input (kWh)	Ventilation Fan (kWh)
January	3	4041	0	25639	5198	3747	4170
February	145	679	0	25605	5256	3789	3766
March	3534	240	0	32010	9575	6903	4170
April	9074	0	0	34995	9817	7077	4035
May	27821	0	0	38951	4877	3516	4170
June	39382	0	0	39817	11113	8011	4035
July	50057	0	0	41480	5690	4102	4170
August	44178	0	0	41812	7264	5236	4170
September	32469	0	0	39759	6876	4957	4035
October	17124	0	0	38843	2709	1953	4170
November	2955	18	0	32268	127	91	4035
December	54	5770	0	27488	8876	6398	4170
Total	**226796**	**10748**	**0**	**418665**	**77377**	**55781**	**49095**

Air System Simulation Results (Table 2) :

Month	Terminal Fan (kWh)	Lighting (kWh)	Electric Equipment (kWh)
January	126	1504	37379
February	127	1359	33761
March	165	1504	37379
April	191	1456	36173
May	240	1504	37379
June	239	1456	36173
July	269	1504	37379
August	266	1504	37379
September	244	1456	36173
October	249	1504	37379
November	172	1456	36173
December	134	1504	37379
Total	**2420**	**17710**	**440102**

Zone Temperature Report for IPS - Control Building - FAHU 1.2 (Tech)

(In Alternative: IPS - HR - Control Building)

Project: Anexo I - Calculations 11-07-2025

Prepared by: IPS 17:25

1. Zone Temperature Statistics

	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Unocc	Unocc	Unocc	Unocc
Zone Name	Max Zone Temp (C)	Hours More Than 2,8 K Above Throt. Range	Hours 0,6 to 2,8 K Above Throt. Range	Cooling Setpoint plus Throt. Range (C)	Hours Within Throt. Range or Dead-band	Heating Setpoint minus Throt. Range (C)	Hours 0,6 to 2,8 K Below Throt. Range	Hours More Than 2,8 K Below Throt. Range	Min Zone Temp (C)	Max Zone Temp (C)	Cooling Setpoint plus Throt. Range (C)	Heating Setpoint minus Throt. Range (C)	Min Zone Temp (C)
1.2.01 Marshaling Room	26,0	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.02 Auxiliary Room	26,1	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.03 Server Room	26,3	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.04 UPS Room	26,7	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.05 Security Equipment Room	26,8	0	0	26,4	8760	4,2	0	0	25,6	na	na	na	na
1.2.06 Battery Room	25,6	0	0	26,4	8760	4,2	0	0	14,9	na	na	na	na
1.2.07 Machine Room	25,6	0	0	26,4	8760	4,2	0	0	21,1	na	na	na	na
1.2.08 Water Tanks	25,7	0	0	26,4	8760	4,2	0	0	18,2	na	na	na	na

Note: For any occupied hours in which heating or cooling is unavailable or scheduled off, zone temperature out of range statistics are not reported.

Anexo IX

Catálogo Humidificador Adiabático

Catálogo de humidificadores adiabático da marca HygroMatiK.

1 Humidifier LPS/HPS
2 Reverse Osmosis WaterLine RO

HYGROMATIK®
WE HUMIDIFY THE AIR

Humidification and cooling

Adiabatic low and high pressure systems

LPS and HPS

Hygienic.
Efficient.
Certified.

HygroMatik since 1970
MORE THAN 50 YEARS
Quality and Innovation

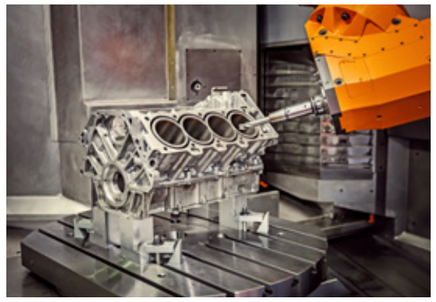
TÜV NORD
Tested Hygiene Requirements Humidifying System "HPS"
SEIT/1068/10-A

TÜV NORD
Tested Hygiene Requirements Humidifying System "LPS"
SEIT/1068/10-B

And the forecast for today.

AIR HUMIDITY: OPTIMAL TEMPERATURE: COMFORTABLE

Used for **comfort and process humidification and cooling**, e.g. in office complexes, shopping centres, production facilities and manufacturing plants.



EFFICIENT HUMIDIFICATION AND COOLING

Our adiabatic humidification systems LPS and HPS have been developed for efficient use in **comfort humidification.** They provide for example in office complexes, hotels, shopping centres or clean rooms for the optimum relative humidity of the room air (comfort zone 40-60%) and are therefore an important element in company hygiene concepts and in the development of health-promoting measures.

Also in **process humidification**, e.g. in production plants, in painting facilities or in the automotive and in the aviation industry, they reliably control the air humidity for optimum and stable production conditions.

In addition, **the evaporation of the fine mist cools** the flow air in the duct and thus ensures noticeable cooling of the room air. In the case of exhaust air cooling in summer, **this can save up to ⅓ of the needed cooling capacity** in order to achieve pleasant room temperatures for employees and customers. Also in production plants the primary cooling load can be significantly reduced by reducing process waste heat.

The modular design of our LPS and HPS humidification systems enables **installation or retrofitting in almost any air-conditioning duct.** With a total of 5 performance classes, they can be perfectly matched to your humidification requirements. Up to a humidification capacity of 110 l/h, the **LPS offers a compact humidification system** that can be operated in a low pressure range from 5 to 15 bar (Low Pressure System). The **more powerful HPS** works in the high pressure range with a pressure of 25 to 75 bar (High Pressure System) and enables a humidification performance of up to 600 l/h.

Adiabatic. Dry. Accurate. Safe.

HYGIENIC, EFFICIENT AND CERTIFIED

ADIABATIC AND DRY

The adiabatic low and high pressure nozzle systems LPS and HPS from HygroMatik humidify the air in air conditioning and ventilation systems with fully demineralised water. The low and high pressure atomisation enables an **optimum spray pattern** with minimum energy consumption. The LPS and the HPS fulfil the hygiene requirements and are certified by TÜV according to VDI 6022.

High-precision stainless steel nozzles generate optimal aerosols, which are particularly quickly absorbed to the air in the humidification chamber. With their different spray angles, individual arrangement and optimum aerosol sizes, they ensure **almost dry walls** in the humidification chamber.

In addition, the Vortex wall made of specially developed **VortexModules** mixes the duct air with the aerosols over the shortest humidification distance. Due to the fast and efficient absorption there is almost no water loss – this saves additionally. The high-quality stainless steel aerosol separators from HygroMatik guarantee an aerosol-free supply air.

Clear LED display with operating buttons (LPS)

ACCURATE AND SAFE

The high-quality system control offers precise, proportional humidification control. Through the constant monitoring of all system components and functions **highest operational safety** is guaranteed.

The forwarding of operating and collective fault messages to your building control system is a matter of course and enables **short reaction times in the event of a fault.**

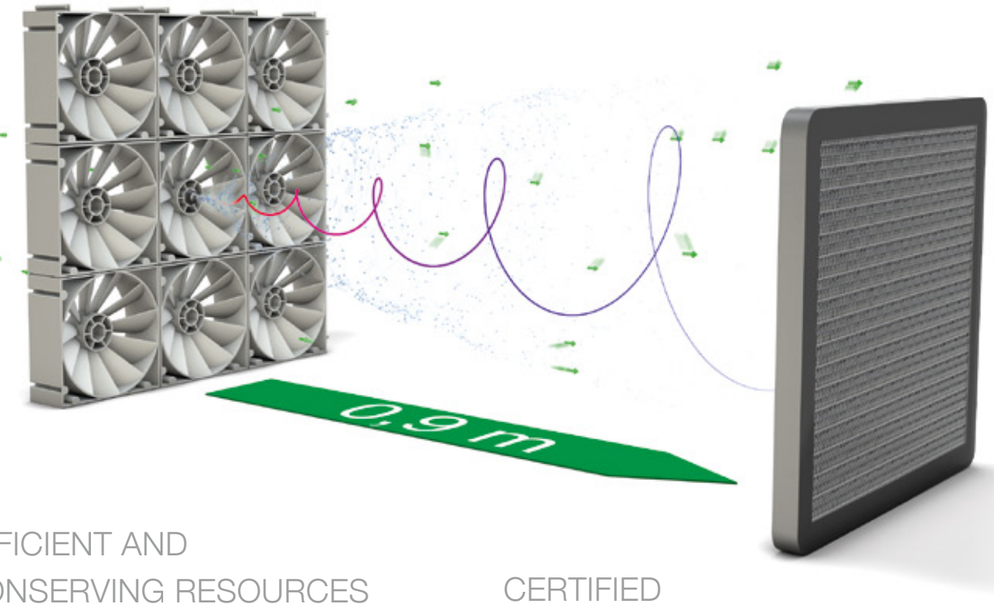
Capacitive 3.5“ touch colour display (HPS)

HYGIENIC

Our hygiene concept deliberately dispenses with biocides and chemical disinfectants. Only the used fully demineralised water* **without additives** is released into the air we breathe.

The systems do not contain any porous or water-storing components. Standing water is effectively prevented, and **when the system is at a standstill it is automatically drained** and rinsed in regular VDI 6022-1 compliant cycles.

In the HygroMatik LPS and HPS, only **inert materials** come into contact with the humidifying water. With their material properties, these ensure hygienically harmless and perfect humidification – the basic requirement in air conditioning technology.



Vortex wall

EFFICIENT AND CONSERVING RESOURCES

The adiabatic systems from HygroMatik offer high humidification performance with low energy demand. Due to their **high degree of efficiency and exact controllability**, the systems allow a particularly efficient use of the resources used.

Humidification with demineralised water* excludes lime precipitation and guarantees **minimum maintenance requirements.**

This ensures a **quick amortisation** of the investment costs and, through the use of high-quality components, a **long service life.**

* Residual conductivity 5-50 µS/cm

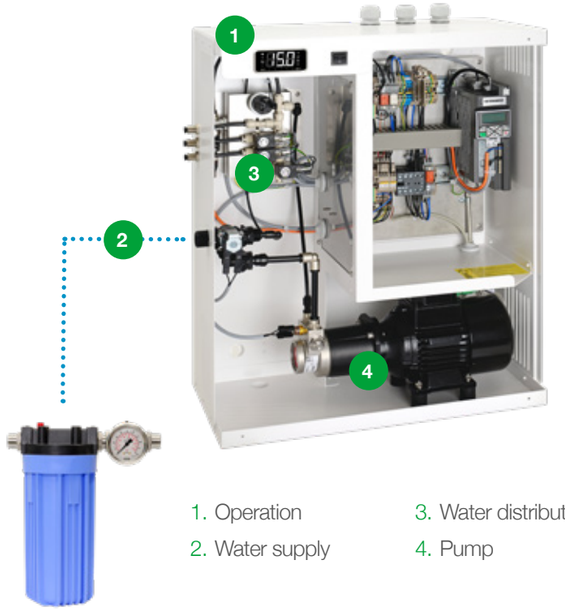
CERTIFIED

LPS and HPS comply with the German standards VDI 6022-1 and VDI 3803-1 as well as the comparable Austrian and Swiss standards.

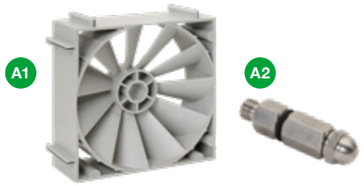
A recognised independent testing institute has examined and confirmed conformity with the guidelines and the current state of the art (TÜV certificate numbers: SEIT/1068/18-B for LPS, SEIT/1068/18-A for HPS).

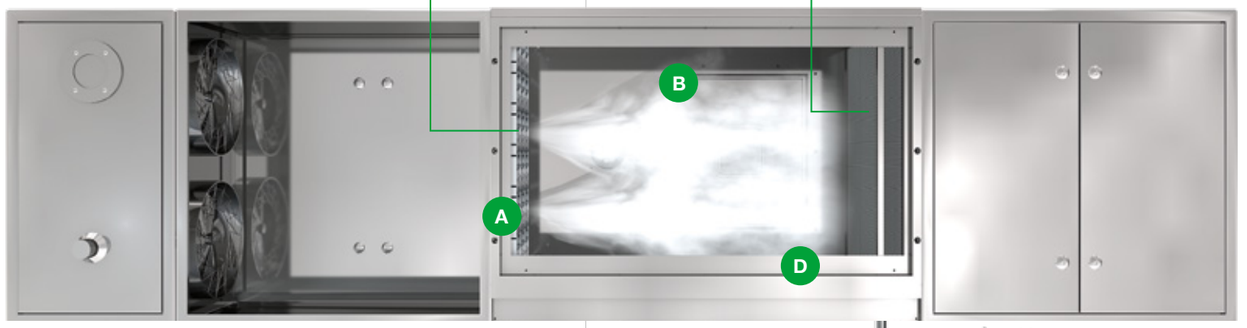
LOW PRESSURE SYSTEM

LPS

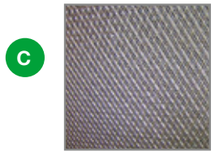


1. Operation
2. Water supply
3. Water distributor
4. Pump





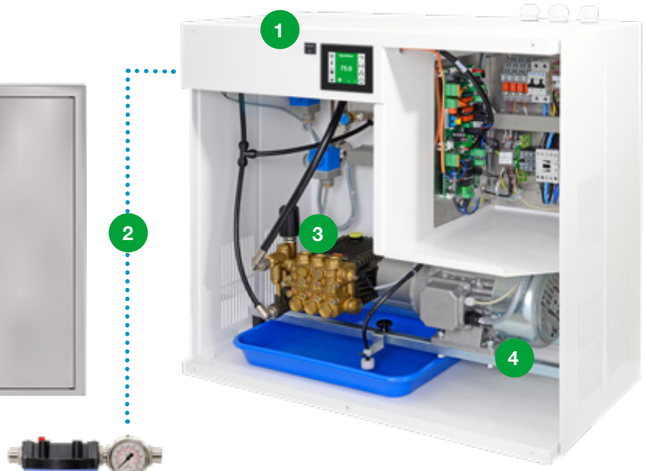
A. VortexModule wall
A1. VortexModule
A2. Nozzle
B. Window with darkening according to VDI 6022-1
C. Aerosol separator 2-stage



D. Humidification chamber with service door and water tray
E. Water drainage (with siphon)

HIGH PRESSURE SYSTEM

HPS



1. Operation
2. Water supply
3. Water distributor
4. Pump

Performance characteristics

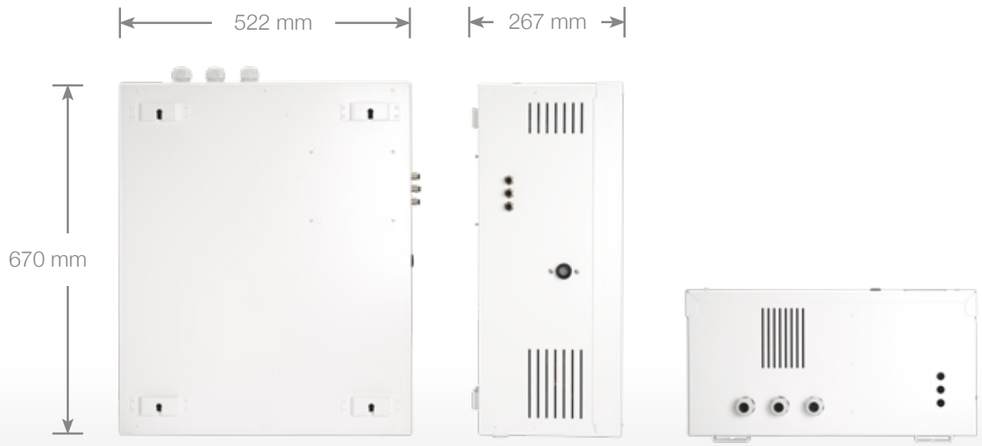
	LPS	HPS
Humidification output	up to 110 litres per hour	up to 600 litres per hour
Efficiency	up to 80%	up to 98%
Low energy consumption with particularly low maintenance requirements	✔	✔
Excellent for retrofitting in air conditioners and air washers	✔	✔
Time-saving installation due to uncomplicated construction and simple commissioning	✔	✔
Use of only inert materials	✔	✔
Capacitive 3.5“ touch colour display with convenient menu navigation to set the relevant operating parameters	–	✔
Clear LED display with control buttons for quick and intuitive navigation	✔	–
Annual maintenance according to service schedule	nozzles + water filter	nozzles + water filter + pump
Adjustment of the rinsing and idling parameters during commissioning	✔	✔
Especially low noise	✔✔	✔
ModBus and BacNet protocols	✔	✔

LOW PRESSURE SYSTEM LPS

WORKING PRESSURE: 5-15 BAR

HUMIDIFICATION OUTPUT: 4-110 LITRES/H

LPS



Technical data LPS

Type		45	72	110
Effective humidification performance	[kg/h]	up to 45	up to 72	up to 110
Humidification capacity max. (15 bar)	[l/h]	56	90	140
Current connection	[A]	1.9	2.1	2.7
Performance	[kW]	0.44	0.48	0.62
Voltage connection	[V/Ph/Hz]	230 / 1 / N / 50-60		
Control signal *	[V/mA/Ohm]	0-10 / 4-20 / 0-140		
Dimensions of VortexModules	[mm]	150 x 150		
Max. number of nozzles		15	22	32
Humidification distance, optimum	[m]	0.9		
Installation length, optimum	[m]	1.5		
Flow rate	[m/s]	0.9-2.8		
Pressure drop in duct (dry)	[Pa]	80 at 2.0 m/s air velocity		
Water connection		fully demineralised water, residual conductivity 5-50 µS/cm		

* Other control signals on request.
We reserve the right to make technical changes.

HIGH PRESSURE SYSTEM HPS

WORKING PRESSURE: 25-75 BAR

HUMIDIFICATION OUTPUT: 14-600 LITRES/H

HPS

Technical data HPS

Type		250	500
Effective humidification performance	[kg/h]	up to 250	up to 600
Humidification capacity max. (75 bar)	[l/h]	260	620
Current connection	[A]	6.45	10.4
Performance	[kW]	1.48	2.4
Voltage connection	[V/Ph/Hz]	230 / 1 / N / 50-60	
Control signal *	[V/mA/Ohm]	0-10 / 0-20 / 0-140	
Dimensions of VortexModules	[mm]	150 x 150	
Max. number of nozzles		6-39	18-104
Humidification distance, optimum	[m]	0.9	
Installation length, optimum	[m]	1.5	
Flow rate	[m/s]	0.9-2.8	
Pressure drop in duct (dry)	[Pa]	80 at 2.0 m/s air velocity	
Water connection		fully demineralised water, residual conductivity 5-50 µS/cm	

* Other control signals on request.
We reserve the right to make technical changes.

Our service for 100% customer satisfaction

- Long availability for replacement parts
- Technical hotline +49 4193 895-293
  or hotline@hygromatik.com
- HygroMatik distributes in more than 45 countries
- Operating manuals, planning data and information
  on workshop events available online at
  www.hygromatik.com

HygroMatik
WE HUMIDIFY THE AIR

HygroMatik GmbH
Lise-Meitner-Str. 3
24558 Henstedt-Ulzburg
Germany

T +49 4193 895-0
F +49 4193 895-33
hy@hygromatik.de
www.hygromatik.com

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10/2022

HygroMatik®
WE HUMIDIFY THE AIR

Reverse osmosis systems
for hygienic water treatment

WaterLine RO

Hygienic.
Efficient.
Safe.

HygroMatik since 1970
50 YEARS
Quality and Innovation

Reverse Osmosis Water Treatment

EFFECTIVE PROTECTION FOR AIR HUMIDIFICATION AND COOLING SYSTEMS

REDUCES LIME AND SALTS

Before our drinking water is fed into the water pipes, it flows through numerous different layers of rocks. Depending on the region, it therefore contains more or less minerals such as calcium and magnesium. If this water is used, for example, in steam humidifiers **for air humidification,** it can accumulate in the form of lime and salt deposits on the heating elements and damage them.

For this reason, we recommend precautionary water treatment with a **WaterLine reverse osmosis system** from a hardness level of **18.8 °e (268 ppm).** Harmful deposits can be reduced by up to 95%.

The maintenance effort and thus the operating costs of air humidification and cooling systems can be noticeably reduced by water treatment and the average operating time is significantly extended.

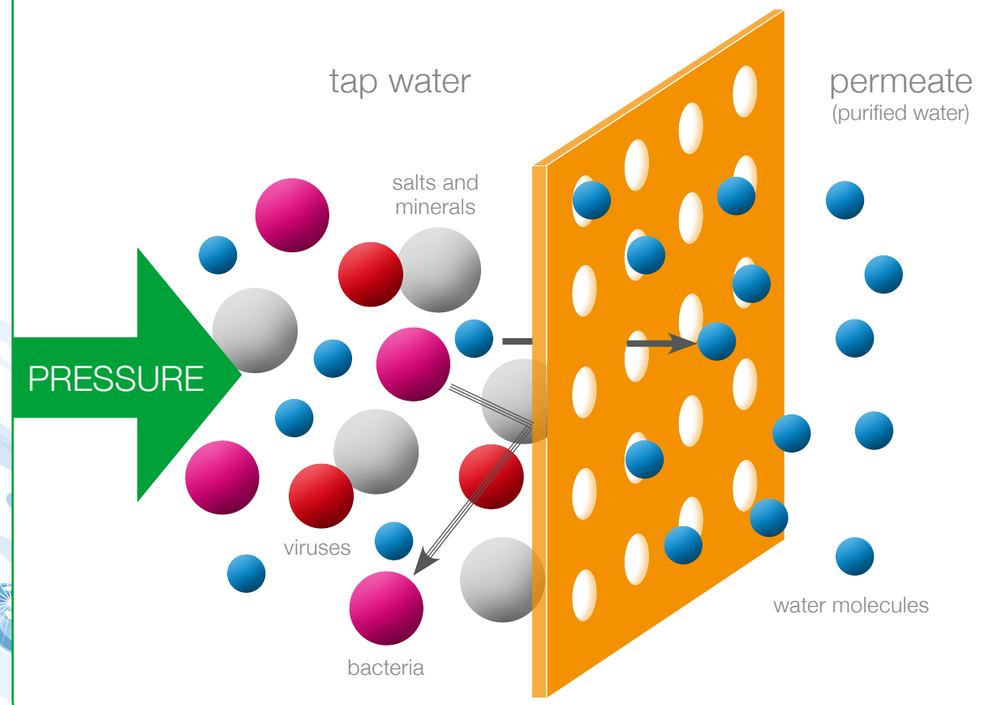
AVOIDS VIRUSES AND BACTERIA

But not only lime and salt crystals are removed from the water by the cleaning process. The water treatment with a WaterLine RO system is also a very effective protection against viruses and bacterial contamination in air humidification and cooling systems.

Viruses and bacteria present in the water are filtered out by the process of reverse osmosis – even before they reach the air humidification systems. This prevents them from spreading and being released into the room air.

For this reason, the integration of a system for water treatment using reverse osmosis is particularly recommended when planning air humidification systems **in hygienically sensitive application areas.**

FUNCTIONAL DIAGRAM
OF REVERSE OSMOSIS PROCESS



WHAT HAPPENS AT THE REVERSE OSMOSIS PROCESS?

In the reverse osmosis process, the water to be treated is forced under high pressure through a **semi-permeable membrane with pores less than 0.001 µm.** This makes it possible to separate undesirable components of tap water, such as viruses, bacteria, minerals, pesticides, hormones and heavy metals from the water molecules.

Result: Permeate - water with an above average high degree of purity.

Compact in 4 performance classes from 25 to 140 l/h

WaterLine ROC (Reverse Osmosis Compact)

Pressure expansion tank with wall bracket
Volume optionally 18 or 40 litres
Stand pressure expansion tank possible on request

MANY FUNCTIONS – SIMPLE OPERATION

The integrated control and operating unit with its clearly laid out display enables convenient and simple operation of the WaterLine ROC system.

- Display of fault and operating messages
- Maintenance indicator and operating hours counter
- Conductivity display (permeate) with adjustable limit value of maximum permissible water conductivity (safety shutdown of the system can be capitalised if the limit is exceeded)
- External release via potential-free contact possible
- Programmable forced flushing
- Integrated pressure switch

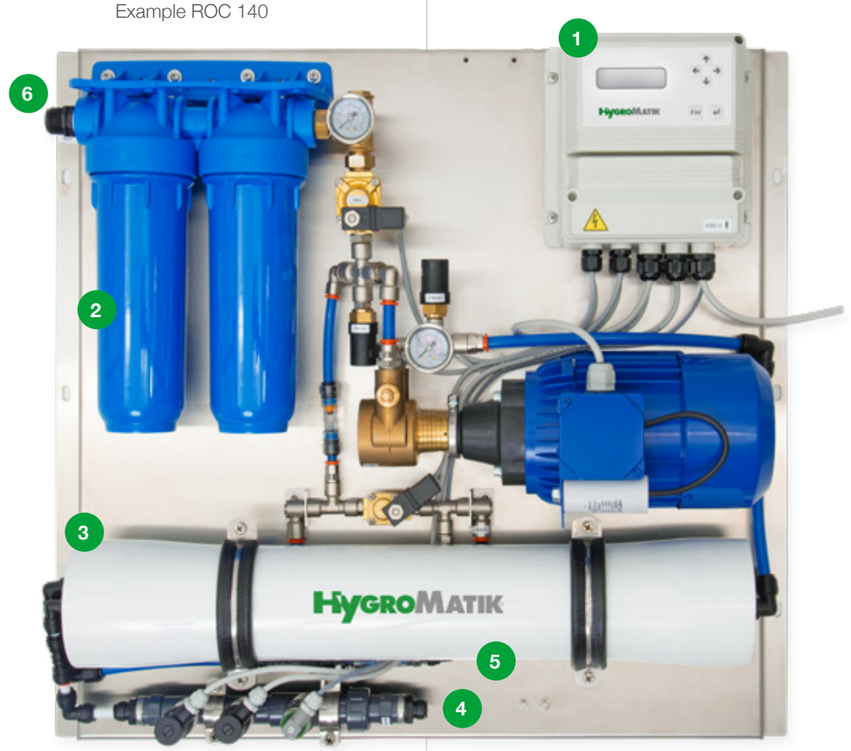
Optional functions and components:

- Adjustable blending unit to increase permeate conductivity (when used with electrode steam humidifier and optional conductivity sensor)
- External UV disinfector for maximum hygiene
- Expansion tank for constant pressure between 2-4 bar

SPACE-SAVING WALL MOUNTING AND QUICK INSTALLATION

The WaterLine ROC can be mounted on a load-bearing wall in the tightest of spaces. To make the installation as quick and easy as possible, the entire system is supplied on a corrosion-resistant mounting plate ready for connection. It is attached to a load-bearing substructure via 4 mounting points (Ø 10 mm).

Example ROC 140



1. Control and operating unit
2. Two pre-filters for water components with 10 and 5µm (only ROC 140)
3. Pressure tube with membrane
4. Permeate connection
5. Concentrate connection
6. Raw water connection

MAINTENANCE-FRIENDLY AND COMPACT SYSTEM DESIGN

Despite the compact system design, the change of the pre-filter as well as the membrane can be done quickly and easily.

The WaterLine ROC system is also characterised by long maintenance intervals. With optimum water quality (drinking water up to 25.0 °e with maximum salt content [TDS] 357 ppm (>1000 µS/cm)). The membrane can be used for up to one year.

WATER PRETREATMENT

In order to protect the membrane of the WaterLine ROC system from excessive wear caused by lime deposits, additional water pretreatment should be planned, depending on the water hardness of the raw water:

- **Up to 25 °e (357 ppm):** Possible without water pretreatment
- **Above 25 °e (357 ppm):** Water softening with softening unit (e.g. WaterLine Double)
- **Exception up to 35 °e (500 ppm):** Dosing pump for antiscalant possible
- Dosing pump optional available for WL-ROC-140

Power in 6 output classes from 160 to 1,200 l/h

WaterLine ROL (Reverse Osmosis Large)

MANY FUNCTIONS – SIMPLE OPERATION

The integrated control and operating unit with its clearly laid out display allows convenient and simple operation of the WaterLine ROL system.

- Display of fault and operating messages
- Maintenance indicator and operating hours counter
- Conductivity display for permeate and untreated water with adjustable limit value of the maximum permissible water conductivity (safety shutdown of the plant if this is exceeded)
- External release and alarm message possible via potential-free contact
- Programmable forced flushing
- Integrated pressure switch

Optional functions and components:

- External UV disinfector for maximum hygiene
- Expansion tank for constant pressure between 2-4 bar

QUICK INSTALLATION

The WaterLine ROL is supplied completely pre-assembled on a stable support frame and is thus prepared for quick installation and commissioning.

WATER PRETREATMENT

In order to protect the membrane of the WaterLine ROL system against rapid wear caused by lime deposits, additional water pretreatment has to be planned, depending on the hardness of the raw water:

- **Up to 35 °e (500 ppm):** Optionally with integrated dosing pump, injection point and empty canister for antiscalant or softening system
- **Above 35 °e (500 ppm):** Water softening with softening unit (e.g. WaterLine Double)

Pressure expansion tank with stand
Volume optionally 80 to 500 litres

1. Control unit
2. Prefilter for water components with 10 and 5µm
3. Pressure tube with membrane
4. Permeate connection
5. Concentrate connection
6. Dosing pump for antiscalant
7. Tank for antiscalant mixture

Hygienic, easy to maintain, durable

HIGH-QUALITY COMPONENTS

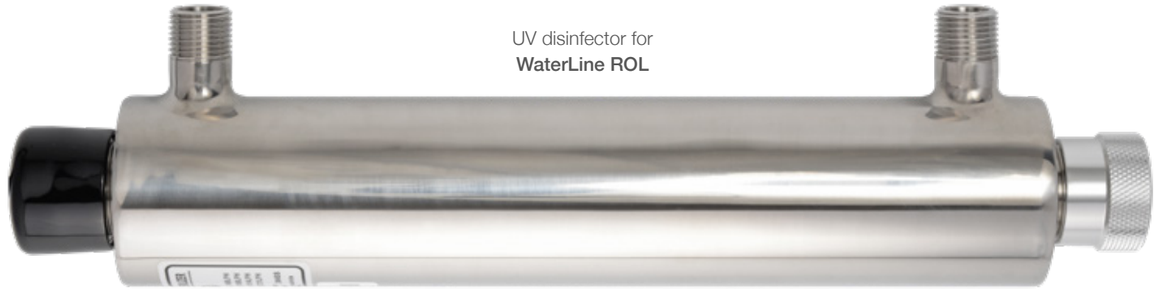
DURABLE PRESSURE EXPANSION TANKS

The generated permeate is stored in a pressure expansion tank. The pure water is simply and efficiently kept at a pressure of 2-4 bar and is available to supply the air humidification system as required. Seven sizes can be combined depending on the design of the system. The 18 and 40 litre sizes are supplied for wall mounting with brackets and fixing materials, all larger models are supplied with stands.

WHICH SIZE FITS WHICH SYSTEM?

	18 litres	40 litres	80 litres	100 litres	200 litres	300 litres	500 litres
WL-ROC-25	✔	(✔)					
WL-ROC-40	✔	(✔)					
WL-ROC-80	(✔)	✔	(✔)				
WL-ROC-140	(✔)	✔	(✔)				
WL-ROL-160		(✔)	✔	(✔)			
WL-ROL-320			(✔)	✔	(✔)		
WL-ROL-460				(✔)	✔	(✔)	
WL-ROL-600				(✔)	✔	✔	(✔)
WL-ROL-1000				(✔)	✔	✔	(✔)
WL-ROL-1200				(✔)	✔	✔	(✔)

✔ recommended (✔) possible



UV disinfector for **WaterLine ROL**

UV disinfector for **WaterLine ROC**

UV DISINFECTOR FOR MAXIMUM HYGIENE

An UV disinfector ensures maximum hygiene conditions. The lamp irradiates the permeate flowing through with UV rays and very effectively removes any biological contaminants still present, such as bacteria, viruses, moulds, spores and yeast fungi.

The procedure is a purely physical process **without the addition of chemicals and is therefore easy to handle, harmless to health and easy to maintain.**

ANTISCALANT DOSING PUMP

To prevent the lime and magnesium residues present in the raw water from being deposited on the membranes and impairing their performance or shortening their service life, the integrated dosing pump with adjustable timer function injects an antiscalant into the raw water pipes at fixed intervals. The HygroMatik Pragmaclean 309 antiscalant complies with the German drinking water regulations.

Antiscalant protects the membrane and extends its lifetime by up to five years.

Dosing pump for all **WaterLine ROL and ROC 140**

WHICH WATERLINE RO FITS WHICH HUMIDIFICATION SYSTEM?

	required	recommended
Steam humidifier		
HygroMatik StandardLine (heater type)		✔ ROC
HygroMatik FlexLine (heater type)		✔ ROC/ROL
HygroMatik FlexLine Plus / Process		✔ ROC/ROL
HygroMatik HeaterSlim		✔ ROC
HygroMatik StandardLine (electrode)	✔ ROC + blending	
HygroMatik FlexLine (electrode)	✔ ROC + blending	
HygroMatik MiniSteam	✔ ROC + blending	
Adiabatic humidifier		
HygroMatik High Pressure System (HPS)	✔ ROL	
HygroMatik Low Pressure System (LPS)	✔ ROC/ROL	
CAREL humiFog	✔ ROC	
Ultrasonic nebuliser		
CAREL humiSonic direct	✔ ROC	

WL-ROC-25 to 80

WL-ROC-140

WL-ROL-160 to 1200

Technical data — wall mounted compact units **WL-ROC**

Type	WL-ROC-25	WL-ROC-40	WL-ROC-80	WL-ROC-140
Permeate capacity [± 10%] [l/h at 15°C]	25	40	80	140
Water consumption during operation [l/h]	50	80	160	280
Permeate yield [%]	50	50	50	50
Number of membranes	1 x 12“	2 x 12“	2 x 12“	1 x 21“
Membrane pressure max. [bar]	10			
Water hardness max. [°e (ppm)]	25 °e (357 ppm) without pretreatment (otherwise: softening system)			
Salt content max. (TDS) [ppm]	700			
Water feed conductivity max. [µS/cm]	1000			
Inlet water temperature [°C]	5-25			
Inlet water pressure [bar]	2-5			
Water pressure permeate max. [bar]	4			
Electrical power supply [kW]	0.3	0.3	0.3	0.6
Rated power [V/Hz]	230V / 1Ph / N / 50Hz			
Feed water inlet	3/4“ AG			
Permeate pipe connection	John Guest Ø 10 mm			
Water outlet	John Guest Ø 8 mm			John Guest Ø 12 mm
Dimensions W x H x D [mm]	420 x 580 x 235			770 x 700 x 220
Operating weight [kg]	19	21	21	41
Flushing function	no			yes
Antiscalant dosing pump	no			optional *
Conductivity measurement	1 x permeate monitoring with alarm function included			
Blending kit for electrode humidifier	optionally available			

stand systems **WL-ROL**

WL-ROL-160 *(AS)	WL-ROL-320 *(AS)	WL-ROL-460 *(AS)	WL-ROL-600 *(AS)	WL-ROL-1000 *(AS)	WL-ROL-1200 *(AS)
160	320	460	600	1000	1200
320	470	920	1200	1500	1770
50	68	50	50	68	68
2 x 40“	4 x 40“	2 x 40“	2 x 40“ XL	4 x 40“	4 x 40“ XL
10					
can only be operated with an upstream softening plant or antiscalant dosing device					
750					
1000					
5-25					
2-5					
4					
1.0	1.0	1.7	1.7	2.1	2.1
230V / 1Ph / N / 50Hz					
3/4“ AG					
John Guest Ø 15 mm				3/4“ AG	
John Guest Ø 15 mm				3/4“ AG	
940 x 1555 x 510		1090 x 1555 x 700			
75	83	100	100	125	125
yes					
only included in antiscalant („AS“) version					
1 x raw water monitoring, 1 x permeate monitoring and alarm function included					
not possible					

* Operation with antiscalant dosing pump possible. The permeate yield in ROL systems increases to 75% when using softened water.

Subject to technical changes.

Our service for 100% customer satisfaction

- Long availability for replacement parts
- Technical hotline +49 4193 895-293
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HygroMatik
WE HUMIDIFY THE AIR

HygroMatik GmbH
Lise-Meitner-Str. 3
24558 Henstedt-Ulzburg
Germany

T +49 4193 895-0
F +49 4193 895-33
hy@hygromatik.de
www.hygromatik.com

member of **CAREL group**

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