

**ENERGY REPORT
INDUSTRIAL UNIT
PENRHYN ROAD
KNOWSLEY BUSINESS PARK
KNOWSLEY
MERSEYSIDE**

CLIENT:
KNOWSLEY DEVELOPMENTS LTD
THE OLD FORGE
49 HIGH STREET
HENLEY-IN-ARDEN
B95 5AA

PREPARED BY:
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REVISION A – OCTOBER 2021
REVISION B – NOVEMBER 2021



CONTENTS

	PAGE
1.0 EXECUTIVE SUMMARY	3
2.0 INTRODUCTION	4
3.0 SITE AND BUILDING SUMMARY	5
4.0 ENERGY STRATEGY	6
5.0 BE LEAN	6
6.0 BE CLEAN	9
7.0 BE GREEN	10
8.0 COOLING & OVERHEATING	15
9.0 CONCLUSION	15
APPENDICIES	
As Designed BRUKL	
As Designed Data Reflection Report	
Details of lighting for the assumed fit out	

1.0 EXECUTIVE SUMMARY

This energy report has been produced for the planning application for the new industrial development at Penrhyn Road Knowsley Business Park, Merseyside.

The site comprises a single industrial building (Class B2/B8) of shell and core construction. The fit out of the warehouse areas undertaken by the future occupier. The building has been assessed based on an assumed fit out including an un-heated warehouse.

The energy report follows the Knowsley local plan core strategy (January 2016) with particular reference to CS22 and CS23.

No target for carbon reduction or renewable contribution is detailed in the policy documents, however reduction of carbon emissions is encouraged

The report details how the energy efficiency of the development has been improved compared to a Building Regulation compliant building and the reduction in carbon emissions achieved.

The table below provides a summary of the results.

TER (kgCO ₂ /m ² /annum)	BER (kgCO ₂ /m ² /annum)	% Improvement
12.4	6.7	45%

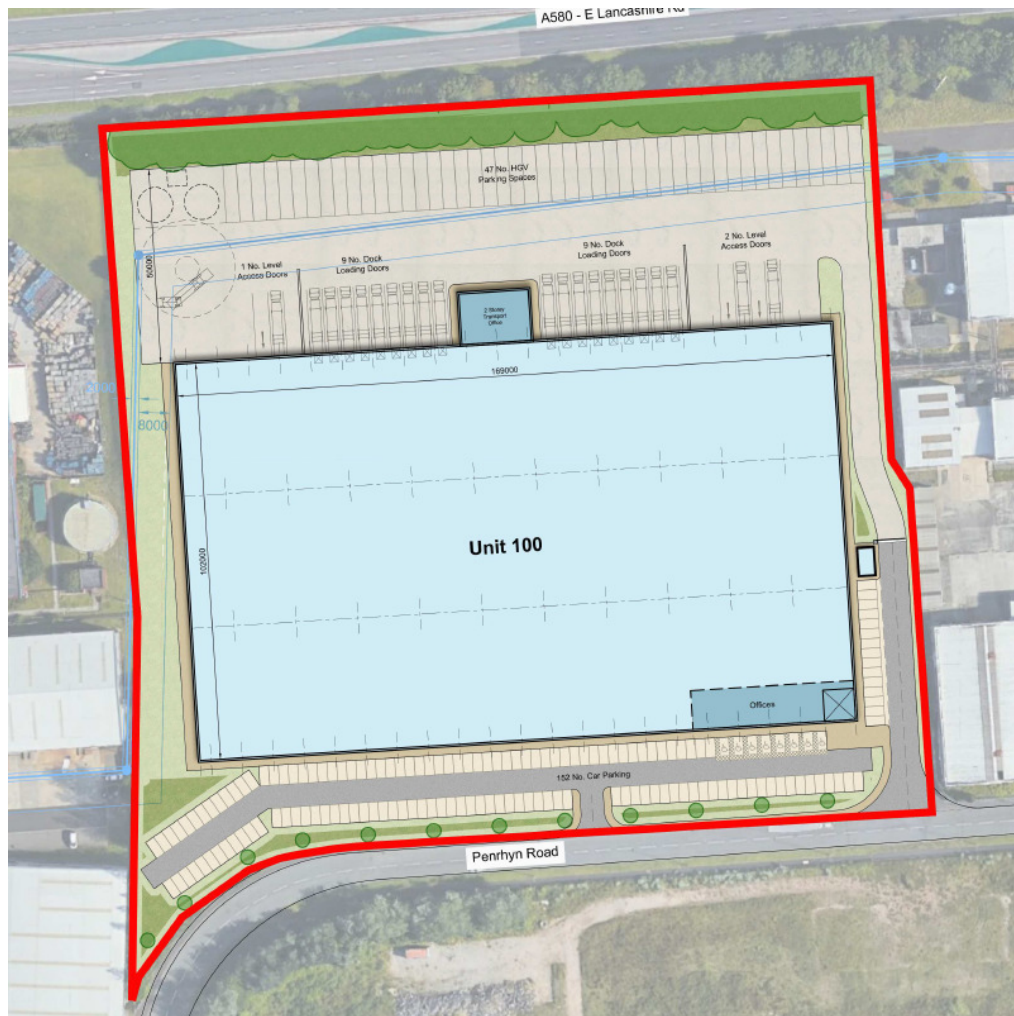
This provides a total saving of 106,454 kgCO₂/annum

The use of local heat networks has been investigated, however due to the industrial nature of the buildings, the clients requirements for comfort cooled office spaces and the anticipated future fit out of the units it was established that connection to a local heat network was not viable for this development.

Renewable technologies have been investigated with the conclusion that roof mounted PV panels and air source heat pumps are the most viable for this development. The Air source heat pumps have been incorporated into the scheme via the heating and cooling system to the offices. PV has not been incorporated, however the roof has been designed to allow future PV systems to be installed by a future occupier.

2.0 INTRODUCTION

Halligan Consulting Engineers have been commissioned by Knowsley Developments Ltd to prepare an energy report to accompany the planning application for the proposed industrial unit at Penrhyn Road, Knowsley Business Park, Merseyside.



The energy report follows the Knowsley local plan core strategy (January 2016) with particular reference to CS22 and CS23.

Policy CS22

Sustainable and Low Carbon Development

Sustainable Construction Principles

- 1) New development will be required to meet high standards of sustainable design and construction and minimise carbon emissions. This should be achieved by:
 - a) Designing new buildings for flexible uses throughout their lifetime;
 - b) Avoiding the creation of adverse local climate conditions by using natural systems to avoid internal overheating and excessive heat generation;
 - c) Ensuring developments are comfortable and safe for users;
 - d) Making the most effective and sustainable use of water, aggregates and other resources;
 - e) Limiting energy use by incorporating high standards of insulation, heat retention, natural ventilation and passive solar techniques;
 - f) Landscaping (including measures such as green walls or roofs) to create shelter and reduce any heat island effect;
 - g) Using sustainable materials from local suppliers where possible;
 - h) Supplying energy efficiently and incorporating decentralised energy systems, using renewable and low carbon energy where feasible;
 - i) Managing flood risk, including through the use of Sustainable Drainage Systems (SuDS) and flood resilient design for infrastructure and property; and
 - j) Promoting sustainable waste practices in new and existing developments.

The energy report demonstrates how compliance with Building Regulations part L2A is achieved.

A BREAM pre-assessment has been undertaken demonstrating how the development achieves a BREEAM Excellent rating.

The report will follow the energy hierarchy Be Lean, Be Clean, Be Green.

3.0 SITE AND BUILDING SUMMARY

The proposed development shall be located at Penrhyn Road, Knowsley Buisness Park, Merseyside.

The development is located in an existing industrial area.

The proposals comprise the construction of a single industrial unit with typical metal clad to shell and core specification only. Fit out of the

warehouse areas will be carried out by the occupier to suit their requirements.

4.0 ENERGY STRATEGY

The proposed units have been modelled utilising the governments SBEM software (5.6.b.0).

The energy strategy follows the Be Lean, Be Clean, Be green energy hierarchy which is detailed below:

Be Lean

This stage reduces the energy used in the building through the incorporation of energy efficient features and improvements to the building fabric.

Be Clean

This stage considers connection into district heating systems, local energy centres and also considers the use of CHP plant within the development.

Be Green

This stage considers the use of Renewable technologies within the development to further reduce the energy on site.

5.0 BE LEAN

To provide carbon savings beyond the base Part L 2016 Building Regulations (TER) the following passive design and energy efficiency measures are to be incorporated into the design of the building.

Building Fabric U-Values

To reduce the CO₂ emissions of the development, it is important to minimise the heat losses through the building fabric. In order to achieve this, U-Values for all building fabric elements and openings have been specified to exceed the levels required by current Building Regulations. The below table details the proposed U-Values for the development.

Element	Building Regulations (W/m ² k)	Proposed New Elements (W/m ² k)
External Wall	0.35	0.26
Floor	0.25	0.11
Roof	0.25	0.18
Windows	2.2	1.4
Rooflights	2.2	1.3
Pedestrian doors	2.2	1.8
Vehicle doors	1.5	1.2

Thermal Bridging

All thermal bridging will be mitigated through the use of enhanced accredited construction details, or bespoke arrangements to ensure the fabric efficiency is not compromised.

Air Permeability

In addition to the incorporation of low U-Values it is proposed that the buildings will also target an air tight construction standard with design air permeability of 2.0m³/hr/m² @ 50Pa.

Building Regulations Part L 2016 currently requires an air permeability level of no greater than 10.0m³/hr/m² @ 50Pa.

This enhancement will therefore assist in reducing the space heating demand of the development and provide a significant improvement in energy efficiency.

Passive Solar Design

The proposed development has significant amounts of glazing to the office areas and entrance areas, therefore façade glazing will be optimised throughout the development in order to balance good daylighting and passive solar heat gains against winter heat losses and to also reduce the risk of solar gain.

In order to assist in reducing the risk of solar gain, low emissivity solar control glazing is proposed throughout the development. This glazing will help to retain thermal energy over the winter period whilst reducing incoming solar gains during the summer months.

Element	G Value	Light transmittance
Windows	0.41	0.6
Rooflights	0.6	0.6

Mechanical & Electrical Systems

As the unit is constructed to shell and core specification the mechanical and electrical systems to the warehouse will not form part of the contracted works. The office areas will be fitted out to Cat A standards as part of the works. The SBEM requires the input of mechanical and electrical systems to calculate the energy demand and CO₂ emissions of the building. The mechanical and electrical services provided as part of the fit out will need to be high efficiency systems, the systems included within the calculations are detailed below:

- Unit heating – unheated
- Air source heat pumps to main office areas via the use of a VRF/VRV air conditioning system.
- Direct electric heating to core areas
- Hot water generated by local low storage electric units
- Mechanical ventilation with heat recovery to office areas
- Energy efficient ventilation systems with low SFP's
- Energy efficient LED lighting to all areas
- Energy efficient lighting controls with occupancy sensing and where possible daylight control

Based on the U values and services detailed above the following energy reductions are achieved for the building.

Energy Consumption by End Use [kWh/m ²]		
	Actual	Notional
Heating	0.71	1.17
Cooling	0.91	0.84
Auxiliary	0.36	0.31
Lighting	7.02	19.22
Hot water	4.21	4.85
Equipment*	30.61	30.61
TOTAL **	13.21	26.39

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

As these are speculative units the final end users' requirements are unknown the final energy demand is unknown and therefore based on the assumptions detailed in this report.

6.0 BE CLEAN

It has been noted Knowsley Business Park is identified as a priority zone with regard to decentralised energy networks.

Taking the above into account it has been considered during the detailed assessment if the use of connections into an Energy network are viable for a site of this nature.

The heating demand for the building is low based on an unheated warehouse. The office areas have a small footprint and therefore the energy use for heating in the space, taking into account the improved thermal elements of the buildings will be low.

The district heating system could be utilised for the hot water demand to the building, but for a speculative unit the demand for hot water is low.

It has been considered if the district heating system could be utilised for heating the warehouse units, however these types of units are usually provided with gas fired warm air heating or radiant heating and the district heating network would not be suitable for these systems.

Taking the above into account it has been established connection into a local district heat networks would not be suitable for this development, however during the detailed design stage consideration should be given to the installation of infrastructure within the development to allow future occupiers the facility to connect into the network if they have a process suitable for it's use.

CHP systems have also been considered at this stage of the energy strategy and for similar reasons to the district heating system have not been considered viable for this speculative development.

7.0 BE GREEN

This section describes the low and zero carbon technologies which have been considered. The aim is to identify the feasibility of technologies at the site and make recommendations based on cost and effectiveness.

The renewable energy feasibility study has excluded the analysis of fuel cells, hydroelectricity and piezoelectric technologies for incorporation at the proposed development.

This renewable energy feasibility study has assessed the use of solar thermal collectors, biomass heating, ground/air source heat pumps, wind turbines and solar photovoltaic modules.

Wind Turbines

Wind turbines are an established means of capturing wind energy and converting it into usable electricity. Wind turbines come in various sizes depending on the location and electrical requirements.

There are two main types of commercially available wind turbines as described below:

- Horizontal axis wind turbines are traditionally the most common form of wind turbines installed in the UK. They are usually formed of three blades and work best when provided with a constant laminar air flow.
- Vertical axis wind turbines are less efficient but have the advantage that they can cope with variable wind flows as they do not have to 'face' the wind.

The energy output of a wind turbine is extremely sensitive to wind speed and wind characteristics. When deciding on potential areas where wind turbines can be located, checks need to be carried out on average wind speeds and wind direction up and down stream of the turbine, to ensure that it is free from obstructions.



Two other rules of thumb for locating turbines are to locate the turbine hub so that it is;

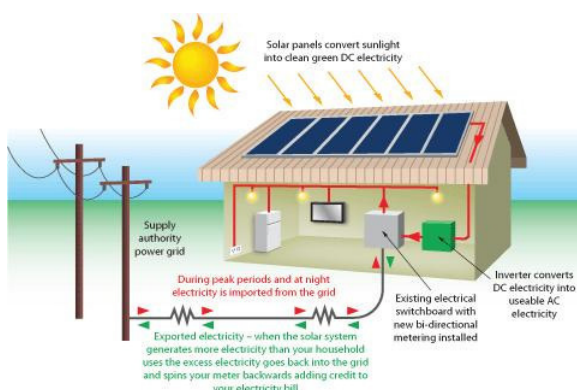
- twice the height of any adjacent obstruction,
- or
- a horizontal distance of 10 times the height of the nearest obstruction away from the obstruction

Building mounted or micro wind turbines are still relatively unproven in urban locations where wind regimes are very unpredictable and there is uncertainty about what can realistically be assumed in terms of their annual electrical output. Early examples notably generated significantly less electricity than was predicted by turbine manufacturers.

Given the constraints and unproven nature of the technology we therefore conclude that wind turbines will not be suitable for this development.

Photovoltaic Array

Solar Photovoltaics (PVs) are panels to generate electricity through photon-to-electron energy transfer, which takes place in the electric material that make-up the cells. The cells are made up from layers of semi-conducting silicon material which, when illuminated by the sun, produces an electrical field which generates an electrical current. PV's can generate electricity even on overcast days, requiring daylight, rather than direct sunlight. This makes them viable even in the UK, although peak output is obtained at midday on a sunny summer's day. PV's offer a simple proven solution to generating renewable electricity.



Crystalline silicon cells are the most efficient of the PV technologies conversion efficiencies of between 15-18% (available solar energy to electricity produced).

Thin film cells have a conversion efficiency of between 5-10%. These are less efficient than silicone derived cells. Thin films can be mounted on folded or curved surfaces and are used extensively in Building Integrated PV products.

As the building on the proposed development will have unshaded roof area which are suitable for mounting solar PV panels, photovoltaic arrays will be considered for the development.

PV systems no longer benefit from the feed-in tariffs and there are no additional grants available for their installation.

The use of a roof mounted PV system has not been included within the calculations, however the roof has been designed to accommodate PV panels as part of the tenant fit out.

Solar Thermal Domestic Water

Solar thermal panels are used to produce hot water for domestic use and consist of roof mounted collector panels that make use of heat energy from the sun and use it to heat water circulating in a closed loop. Usually this heat is transferred via a heat exchanger into a hot water storage tank that is also heated by a gas or other boiler.

Two main types of solar water heating system are used in the UK, flat plate collectors and evacuated glass heat tubes. Flat plate collectors circulate water around a black coloured receiver plate that is heated by direct sunlight and to some extent by indirect light; heat being retained by a thermally glazed panel above. Evacuated glass heat tubes are more efficient, particularly in the UK, as they can work more effectively at low radiation levels. They are however, more expensive than flat plate collectors. They consist of rows of parallel transparent glass tubes, each containing an absorber tube which converts the sunlight into heat energy.



Due to the limited amount of energy required in the building for hot water, solar hot water would not be recommended for this building.

Geothermal Heat Pump

Ground source heat pumps (GSHP) extract heat from the ground. GSHP's work on the principle that the below ground temperature is more constant compared to above ground in the winter months, the below ground temperature is warmer than above ground and the heat carrier fluid circulating within the absorber pipes absorbs the heat.

This heat energy is then raised by a compressor (using the compression cycle) and through a heat exchanger, distributed via a low temperature distribution system such as under floor heating, to satisfy a proportion of space heating requirements.



GSHP systems are not suitable for satisfying high temperature hot water demands.

In the summer months, the below ground temperature is colder than above ground and the heat carrier fluid circulating within the absorber pipes rejects building's heat. This heat rejecting capacity is then raised by a compressor (using the compression cycle) and through a heat exchanger, distributed via a chilled water distribution system to satisfy a proportion of space cooling requirements.

Due to the extensive excavation works involved for this technology the use of GSHP's will not be considered for this development.

Biomass Boilers

Biomass boilers replace conventionally powered boilers with an almost carbon neutral fuel such as wood pellets or wood chips. The fuel is classed as almost carbon neutral because the CO₂ released during the burning of biomass is balanced by that absorbed by the plants during their growth.

The proposed development could allocate space for boilers and fuel storage but fuel would likely be sourced from outside the local area.

Though biomass is a cleaner fuel than gas or heating oil, it should be noted that fossil fuels are utilised in the production, processing and transportation of biomass fuels. Therefore, a key issue when choosing the biomass fuel supplier is the distance between the provider and the boiler equipment as well as the method of transportation.



Biomass energy can be derived from, a number of sources, but are principally divided into three main types: first, second and third generation.

First generation biomass includes raw material which is already in a suitable form for combustion (e.g. firewood), but also include energy crops; plant grown at low cost and low maintenance harvest, which is directly exploited for its energy content. However, the use of first-generation biofuels has been heavily criticised as it is considered that there is a limit to the production of first-generation biofuel without threatening food supplies and biodiversity. Much of the criticism of first-

generation biofuels is due to their use of crops which are diverted from the food chain resulting in food shortages and price rises. On this basis, second generation biofuel technologies were developed to help address these limitations and ensure that biofuel can be produced sustainably.

Second generation biomass consists of residual food parts of crops (e.g. stems, leaves) as well as other crops that are not used for food purposes, and also industry waste. Third generation biofuel is considered to be further efficient, whereby algae culture, which is farmed at low costs, produces biofuels at high yield.

Traditional first-generation woody biomass tends to be a by-product of forest industries or agriculture. The wood fuel generated by forestry can be classified into the following types:

- SRW (small round wood)
- Wood chips and branches
- Brash

Another form of fuel which is manufactured as a by-product of sawmills is wood pellets. These tend to have a higher energy density; lower moisture content and less ash is generated from their combustion. For this reason pellets are often encouraged as they use less storage area, are associated with less boiler maintenance and due to the fact they are manufactured, offer a more consistent quality of fuel.

Although many biomass burners will meet Clean Air Act requirements, combustion of wood biomass releases higher quantities of NO_x, SO_x and particulates compared to a comparable system fuelled by natural gas.

Biomass could technically be burned at the proposed site, but is not preferred given the additional spatial requirements, the management burden of fuel deliveries and additional servicing requirement in the removal of ash. Biomass boilers typically have a high maintenance cost when compared to traditional gas fired boilers.

This type of system is not considered due to reasons detailed above.

Air Source Heat Pumps

Air source heat pumps (ASHP) work on the same principal as ground source heat pumps (GSHP). The difference being that the medium from which the heat is extracted is the external air rather than the ground. An ASHP can be used for both heating and cooling and can also be used to provide



simultaneous heating and cooling to different rooms as required.

The COP's achievable with modern ASHP's mean that these units will produce about 80% of its energy output from the air, a renewable and clean energy source.

The use of ASHP within the office space has been included within this stage of the assessment.

8.0 COOLING AND OVERHEATING

To reduce the risk of overheating solar controlled glazing has been incorporated into the design. In addition to the solar controlled glazing the ventilation systems will incorporate summer bypass functions to allow for free cooling.

The solar gain limit of Building Regulations is not exceeded within the building.

9.0 CONCLUSION

The energy report has demonstrated the development has been designed following the energy hierarchy to reduce the energy used within the development and provide significant carbon dioxide savings over a Building Regulation compliant building.

Following the Energy Hierarchy the development firstly reduces the energy and carbon emissions on site through passive and energy efficient designs incorporated into the buildings.

The table below provides a summary of the results.

TER (kgCO ₂ /m ² /annum)	BER (kgCO ₂ /m ² /annum)	% Improvement
12.4	6.7	45%

This provides a total saving of 106,454 kgCO₂/annum.

The use of local heat networks has been investigated, however due to the industrial nature of the buildings, the clients requirements for comfort cooled office spaces and the anticipated future fit out of the units it was established that connection to a local heat network was not viable for this development.

Renewable technologies have been investigated with the conclusion that roof mounted PV panels and air source heat pumps are the most viable for this development. The Air source heat pumps have been incorporated into the scheme via the heating and cooling system to the offices. PV has not been incorporated; however, the roof has been designed to allow future PV systems to be installed by a future occupier.

During the detailed design of the development the energy calculations will be reviewed to ensure the development maintains compliance with the planning requirements.

APENDICIES

As Designed BRUKL

As Designed Data Reflection Report

Details of lighting used for the assumed fit out

Project name

Shell and Core

Knowsley Unit - Increased wall U value

As designed

Date: Mon Nov 08 13:36:54 2021

Administrative information

Building Details

Address: Penrhyn Road, Knowsley Business Park,
Mersyside, Information not provided by the user

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: iSBEM

Interface to calculation engine version: v5.6.b

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Andrew Steven Clarke

Telephone number: 0121 233 4733

Address: 32 Ludgate Hill, Birmingham, B3 1EH

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	12.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	12.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	6.7
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.26	"z0/02 Hub Offices/si"
Floor	0.25	0.18	0.25	"z2/01 main office/ci"
Roof	0.25	0.18	0.18	"z1/01 hub offices/c"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"z0/02 Hub Offices/e/g"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	2

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF Heating & Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Electric Panels

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- Local Hot Water Heaters

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
z0/02 Hub Offices	-	-	-	1.2	-	-	-	-	-	-	0.75	0.5
z1/01 hub offices	-	-	-	1.2	-	-	-	-	-	-	0.75	0.5
z1/04 main office	-	-	-	1.2	-	-	-	-	-	-	0.75	0.5
z2/01 main office	-	-	-	1.2	-	-	-	-	-	-	0.75	0.5
z0/04 hub toilets	-	-	0.4	-	-	-	-	-	-	-	-	N/A
z0/04a hub toilets	-	-	0.4	-	-	-	-	-	-	-	-	N/A
z0/06 main toilets	-	-	0.4	-	-	-	-	-	-	-	-	N/A
z1/03 hub toilets	-	-	0.4	-	-	-	-	-	-	-	-	N/A
z1/03a toilets	-	-	0.4	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
z1/05 main toilets	-	-	0.4	-	-	-	-	-	-	-	N/A
z2/02 main toilets	-	-	0.4	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
z0/01 Warehouse	YES
z-/05 ll warehouse	YES
z0/02 Hub Offices	NO
z0/08 reception	NO
z1/01 hub offices	NO
z1/04 main office	NO
z1/06 main stairs	NO
z2/01 main office	NO
z2/03 main stairs	NO
z0/03 hub stairs	NO
z0/04 hub toilets	NO
z0/04a hub toilets	NO
z0/06 main toilets	NO
z1/02 hub stairs	NO
z1/03 hub toilets	NO
z1/03a toilets	NO
z1/05 main toilets	NO
z2/02 main toilets	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
z0/01 Warehouse		165	-	-	40247
z-/05 ll warehouse		120	-	-	1171
z0/02 Hub Offices		120	-	-	913
z0/08 reception		-	110	100	160
z1/01 hub offices		120	-	-	910
z1/04 main office		120	-	-	1719
z1/06 main stairs		-	110	-	72
z2/01 main office		120	-	-	1719
z2/03 main stairs		-	110	-	72
z0/03 hub stairs		-	110	-	65
z0/04 hub toilets		-	110	-	57
z0/04a hub toilets		-	110	-	33
z0/06 main toilets		-	110	-	41
z1/02 hub stairs		-	110	-	65
z1/03 hub toilets		-	110	-	57
z1/03a toilets		-	110	-	31

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
z1/05 main toilets		-	110	-	89
z2/02 main toilets		-	110	-	89

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
z0/01 Warehouse	NO (-29.9%)	NO
z-/05 ll warehouse	NO (-76.4%)	NO
z0/02 Hub Offices	NO (-48.5%)	NO
z0/08 reception	NO (-9.9%)	NO
z1/01 hub offices	NO (-48.5%)	NO
z1/04 main office	NO (-22%)	NO
z1/06 main stairs	NO (-9.9%)	NO
z2/01 main office	NO (-22%)	NO
z2/03 main stairs	NO (-9.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	18676	18676
External area [m ²]	46219.2	46219.2
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	2	3
Average conductance [W/K]	9904.34	13613.4
Average U-value [W/m ² K]	0.21	0.29
Alpha value* [%]	6.31	16.24

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.71	1.17
Cooling	0.91	0.84
Auxiliary	0.36	0.31
Lighting	7.02	19.22
Hot water	4.21	4.85
Equipment*	30.61	30.61
TOTAL **	13.21	26.39

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	253.25	256.72
Primary energy* [kWh/m ²]	39.55	68.93
Total emissions [kg/m ²]	6.7	12.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	89.1	165.2	0	0	0	0	0	0	0
Notional	117.2	141.7	0	0	0	0	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	59.5	195.8	4.4	12.8	4.4	3.73	4.26	4	6
Notional	86.8	153.3	9.9	11.8	3.3	2.43	3.6	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	112.8	30.6	39.2	0	4.8	0.8	0	1	0
Notional	134.4	44.8	45.6	0	7.3	0.82	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.26	"z0/02 Hub Offices/si"
Floor	0.2	0.08	"z0/03 hub stairs/f"
Roof	0.15	0.18	"z1/01 hub offices/c"
Windows, roof windows, and rooflights	1.5	1.4	"z0/02 Hub Offices/e/g"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2

SBEM Data Reflection Report — Actual Building

Date: Mon Nov 08 13:36:34 2021

Project name: Knowsley Unit - Increased wall U value type: B8 Storage or Distribution Building area [m2]: 18676

General	
Building address	Pentrhyn Road Knowsley Business Park
Building area [m2]	Mersyside Information not provided by the user
Weather	18676
Building rotation [degrees]	MAN
Special conservation status	0
Project complexity	NO
	-

Certifier/Energy assessor	
Name	Andrew Steven Clarke
Telephone number	0121 233 4733
Address	32 Ludgate Hill Birmingham B3 1EH
Assessor number	-
Qualification	-
Accreditation scheme	-
Employer name	-
Employer address	-

Analysis	
Compliance checked with	England Building Regulations Part L 2013
Asset rating	None
Stage	As designed
Shell & core building	YES

Software	
SBEM version	v5.6.b.0
Interface to SBEM	ISBEM
Interface version	v5.6.b

Summary of objects		
Object type	Total number	Total related area [m2]
Envelope/Door constructions	10	-
Window/Rooflight constructions	2	-
HW systems	1	-
SE systems	0	0
PV systems	0	0
Wind generators	0	-
CHP generators	0	-
HVAC systems	4	-
Zones	18	18676
Envelopes	108	48996.7
Doors	5	238.8
Windows/Rooflights	18	2078.72

Project building services	
Electric power factor	>0.95
Submetering and M&T for lighting systems	YES
Emission factor for district heating [kgCO2/kWh]	0.293
Primary energy factor for district heating [kWh/kWh]	1.2

Envelope/Door constructions				
Name	U-value [W/m2K]	Adjusted U-value	Km [kJ/m2K]	Metal clad
External Cladding	0.26	NO	7	YES
Warehouse / Office Wall	0.26	NO	11.7	NO
Block Wall	1.7	NO	75	NO
Main Roof	0.18	NO	7	YES
Hub Office Roof	0.18	NO	7	YES
Ground Floor	0.11	NO	36	NO
Internal Office floor	1.23	NO	4	NO
Office lid ceiling	0.25	NO	4	NO
Vehicle Door	1.2	NO	4.93	NO
Pedestrian Door	1.8	NO	11.25	NO

Window/Rooflight constructions			
Name	U-value [W/m2K]	Solar transmittance	Light transmittance
Windows	1.4	0.41	0.6
Rooflights	1.3	0.6	0.6

Notes

Hot water systems	
Name	Local Hot Water Heaters
Generator Type	Stand-alone water heater
Fuel type	Grid Supplied Electricity
Seasonal efficiency	1
Uses CHP	NO
Storage system	YES
Storage volume [litres]	-
Insulation thickness [mm]	-
Secondary circulation	NO
Circulation losses [W/m]	-
Pump power [kW]	-
Loop length [m]	-

Notes

Heating, ventilation, and air conditioning systems

Name	Zones without HVAC system	VRF Heating & Cooling	Electric Panels
Type	No Heating or Cooling	Split or multi-split system	Other local room heater - unfanned
Heat source	-	Heat pump (electric) air source	Direct or storage electric heater
Heating fuel type	-	Grid Supplied Electricity	Grid Supplied Electricity
Heating seasonal efficiency	-	4	1
Uses CHP	-	NO	NO
Variable speed pumping type	-	-	-
Generator radiant efficiency	-	-	-
Cooling generator type	-	Heat pump (electric)	-
Cooling fuel type	-	Grid Supplied Electricity	-
Cooling seasonal energy efficiency ratio	-	6	-
Cooling nominal energy efficiency ratio	-	4	-
Mixed-mode cooling operation	-	NO	-
Heat recovery system	-	-	-
Heat recovery seasonal efficiency	-	-	-
Variable heat recovery efficiency	-	-	-
Specific fan power [W/(l/s)]	-	-	-
Submetering and M&T for this system	-	NO	NO
Heating - Central time control	-	-	-
Heating - Optimum stop/start control	-	-	-
Heating - Local time control	-	-	-
Heating - Local temperature control	-	-	-
Heating - Weather compensation control	-	-	-

Notes

Zone name: z0/01 Warehouse	Activity: Warehouse storage	Multiplier: 1
Area [m2]: 16801	Height [m]: 16	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust			General Lighting and controls			Display lighting		
Name	Zones without HVAC system					Efficient lamps	NO	
Destratification fans	NO					Lumens per circuit wattage	-	
Ventilation type	Natural					Time switching	NO	
SFP for local mechanical supply & extract [W/(l/s)]	-							
Heat Recovery system	-							
Heat recovery seasonal efficiency	-							
Variable heat recovery efficiency	-							
Local mechanical exhaust	NO							
Exhaust air flow rate [l/s m2]	-							
SFP for mechanical exhaust [W/(l/s)]	-							
Exhaust fans location	-							
SFP for system terminal units [W/(l/s)]	-							
Demand-controlled ventilation	None							

	-	
Night cooling maximum hours [hours/month]		
Night cooling maximum air flow rate [l/s.m ²]		
Hot water system		
Name	Local Hot Water Heaters	
Shell & core		
Shell area for fit-out	YES	

Envelopes								
(Multiplier) Name	(1) z0/01 Warehouse/s	(1) z0/01 Warehouse/e	(1) z0/01 Warehouse/n	(1) z0/01 Warehouse/w	(1) z0/01 Warehouse/c	(1) z0/01 Warehouse/f	(1) z0/01 Warehouse/si	(1) z0/01 Warehouse/ei
Type	Wall	Wall	Wall	Wall	Flat roof	Floor or Ceiling	Wall	Wall
Area [m2]	1529	1464	2704	2704	17240	16801	502.8	108
Orientation	South	East	North	West	Horizontal	Horizontal	South	East
Adjacent space	Exterior	Exterior	Exterior	Exterior	Exterior	Underground	Unheated	Unheated
Construction name	External Cladding	External Cladding	External Cladding	External Cladding	Main Roof	Ground Floor	Warehouse / Office Wall	Warehouse / Office Wall

Windows & rooflights	
(Multiplier) Name	(175) z0/01 Warehouse/clo
In envelope	z0/01 Warehouse/c
Area [m2]	10
Glazing name	Rooflights
Shading position	None (no shading)
Shading colour	-
Shading translucency	-
Transmission factor	1
Frame / Aspect ratios	0.1 / 0.7

Doors					
(Multiplier) Name	(3) z0/01/s/d	(2) z0/01/e/d	(3) z0/01/n/d	(18) z0/01/n/d1	(2) z0/01/w/d
In envelope	z0/01 Warehouse/s	z0/01 Warehouse/e	z0/01 Warehouse/n	z0/01 Warehouse/n	z0/01 Warehouse/w
Area [m2]	2.4	2.4	20	9	2.4
Type	Personnel	Personnel	Vehicle access	Vehicle access	Personnel
Construction name	Pedestrian Door	Pedestrian Door	Vehicle Door	Vehicle Door	Pedestrian Door

Notes

Zone name: z-/05 II warehouse		Activity: Warehouse storage	Multiplier: 1
Area [m2]: 356		Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls		Display lighting	
Name	Zones without HVAC system			Total wattage [W]	-	Efficient lamps	NO
Destratification fans	NO			Design illuminance [Lux]	-	Lumens per circuit wattage	-
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	120	Time switching	NO
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1		
Heat Recovery system	-			Lamp type	-		
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO		
Variable heat recovery efficiency	-			Controls	BOTH		
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING		
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	NO		
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.05		
Exhaust fans location	-			Automatic zoning for daylight	YES		
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF		
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.05		
Flow regulation type for ventilation control	-						
Night cooling maximum hours [hours/month]	-						
Night cooling maximum air flow rate [l/s.m2]	-						
SFP for night cooling [W/(l/s)]	-						

Thermal bridges Psi values [W/mK]			
Junction type	Metal clad	Not metal clad	
Roof-wall	0.02	0.18	
Wall-ground floor	0.75	0.24	
Wall-wall (corner)	0.02	0.135	
Wall-not ground floor	0	0.11	
Lintel (window/door)	0.05	0.45	
Sill (window)	0.05	0.08	
Jamb (window/door)	0.05	0.09	

Shell & core	
Shell area for fit-out	YES

Envelopes				
(Multiplier) Name	(1) z-/05 II warehouse/s	(1) z-/05 II warehouse/ei	(1) z-/05 II warehouse/f	(1) z-/05 II warehouse/f
Type	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	136.8	42	356	356
Orientation	South	East	Horizontal	Horizontal
Adjacent space	Exterior	Conditioned	Unconditioned	Unconditioned
Construction name	External Cladding	Block Wall	Internal Office floor	Ground Floor

Windows & rooflights				
(Multiplier) Name	(3) z-/05 II warehouse/s/g	(1) z0/05/s/g	(1) z0/05/s/g1	(1) z0/05/s/g1
In envelope	z-/05 II warehouse/s	z-/05 II warehouses	z-/05 II warehouse/s	z-/05 II warehouse/s
Area [m2]	10.8	8.16	4	4
Glazing name	Windows	Windows	Windows	Windows
Shading position	None (no shading)	None (no shading)	None (no shading)	None (no shading)
Shading colour	-	-	-	-
Shading translucency	-	-	-	-
Transmission factor	1	1	1	1
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7	0.2 / 0.7	0.2 / 0.7

Notes

Zone name: z0/02 Hub Offices	Activity: Generic Office Area	Multiplier: 1
Area [m2]: 203	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting																													
Name	VRF Heating & Cooling			Total wattage [W]	-			Efficient lamps	NO																												
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-																												
Ventilation type	Mechanical			Lamp and ballast efficacy [Lumens/W]	120			Time switching	NO																												
SFP for local mechanical supply & extract [W/(l/s)]	1.2			Light output ratio	1			Thermal bridges Psi values [W/mK] <table><tr><th>Junction type</th><th>Metal clad</th><th>Not metal clad</th></tr><tr><td>Roof-wall</td><td>0.02</td><td>0.18</td></tr><tr><td>Wall-ground floor</td><td>0.75</td><td>0.24</td></tr><tr><td>Wall-wall (corner)</td><td>0.02</td><td>0.135</td></tr><tr><td>Wall-not ground floor</td><td>0</td><td>0.11</td></tr><tr><td>Lintel (window/door)</td><td>0.05</td><td>0.45</td></tr><tr><td>Sill (window)</td><td>0.05</td><td>0.08</td></tr><tr><td>Jamb (window/door)</td><td>0.05</td><td>0.09</td></tr></table>						Junction type	Metal clad	Not metal clad	Roof-wall	0.02	0.18	Wall-ground floor	0.75	0.24	Wall-wall (corner)	0.02	0.135	Wall-not ground floor	0	0.11	Lintel (window/door)	0.05	0.45	Sill (window)	0.05	0.08	Jamb (window/door)	0.05	0.09
Junction type	Metal clad	Not metal clad																																			
Roof-wall	0.02	0.18																																			
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Sill (window)	0.05	0.08																																			
Jamb (window/door)	0.05	0.09																																			
Heat Recovery system	Plate heat exchanger (Recuperator)			Lamp type	-																																
Heat recovery seasonal efficiency	0.75			Air-extracting luminaires	NO																																
Variable heat recovery efficiency	YES			Controls	BOTH																																
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING																																
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	NO																																
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.05																																
Exhaust fans location	-			Automatic zoning for daylight	YES																																
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF																																
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.05																																
Flow regulation type for ventilation control	-																																				
Night cooling maximum hours [hours/month]	-																																				
Night cooling maximum air flow rate [l/s.m2]	-																																				
SFP for night cooling [W/(l/s)]	-																																				

Hot water system		
Name	Local Hot Water Heaters	
Dead leg length in this zone [m]	0	

Shell & core	
Shell area for fit-out	NO

Envelopes							
(Multiplier) Name	(1) z0/02 Hub Offices/si	(1) z0/02 Hub Offices/e	(1) z0/02 Hub Offices/n	(1) z0/02 Hub Offices/w	(1) z0/02 Hub Offices/ci	(1) z0/02 Hub Offices/f	
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling	
Area [m2]	38.8	35.6	71.2	54	203	203	
Orientation	South	East	North	West	Horizontal	Horizontal	
Adjacent space	Unheated	Exterior	Exterior	Exterior	Conditioned	Underground	
Construction name	Warehouse / Office Wall	External Cladding	External Cladding	External Cladding	Internal Office floor	Ground Floor	

Windows & rooflights							
(Multiplier) Name	(1) z0/02 Hub Offices/e/g	(1) z0/02 Hub Offices/n/g	(1) z0/02 Hub Offices/w/g				
In envelope	z0/02 Hub Offices/e	z0/02 Hub Offices/h	z0/02 Hub Offices/w				
Area [m2]	9.5	26.24	11.04				
Glazing name	Windows	Windows	Windows				
Shading position	None (no shading)	None (no shading)	None (no shading)				
Shading colour	-	-	-				
Shading translucency	-	-	-				
Transmission factor	1	1	1				
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7	0.2 / 0.7				

Notes

Zone name: z0/08 reception	Activity: Reception	Multiplier: 1
Area [m2]: 59	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls			Display lighting																										
Name	VRF Heating & Cooling			Total wattage [W]	-		Efficient lamps	YES																									
Destratification fans	NO			Design illuminance [Lux]	-		Lumens per circuit wattage	100																									
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110		Time switching	NO																									
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1		Thermal bridges Psi values [W/mK] <table><tr><th>Junction type</th><th>Metal clad</th><th>Not metal clad</th></tr><tr><td>Roof-wall</td><td>0.02</td><td>0.18</td></tr><tr><td>Wall-ground floor</td><td>0.75</td><td>0.24</td></tr><tr><td>Wall-wall (corner)</td><td>0.02</td><td>0.135</td></tr><tr><td>Wall-not ground floor</td><td>0</td><td>0.11</td></tr><tr><td>Lintel (window/door)</td><td>0.05</td><td>0.45</td></tr><tr><td>Sill (window)</td><td>0.05</td><td>0.08</td></tr><tr><td>Jamb (window/door)</td><td>0.05</td><td>0.09</td></tr></table>			Junction type	Metal clad	Not metal clad	Roof-wall	0.02	0.18	Wall-ground floor	0.75	0.24	Wall-wall (corner)	0.02	0.135	Wall-not ground floor	0	0.11	Lintel (window/door)	0.05	0.45	Sill (window)	0.05	0.08	Jamb (window/door)	0.05	0.09
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Sill (window)	0.05	0.08																															
Jamb (window/door)	0.05	0.09																															
Heat Recovery system	-			Lamp type	-																												
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO																												
Variable heat recovery efficiency	-			Controls	BOTH																												
Local mechanical exhaust	NO			Type of photoelectric control	PH-DIMMING																												
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	NO																												
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.05																												
Exhaust fans location	-			Automatic zoning for daylight	YES																												
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF																												
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.05																												
Flow regulation type for ventilation control	-			Hot water system <table><tr><th>Name</th><th>Local Hot Water Heaters</th></tr><tr><td>Dead leg length in this zone [m]</td><td>0</td></tr></table>					Name	Local Hot Water Heaters	Dead leg length in this zone [m]	0																					
Name	Local Hot Water Heaters																																
Dead leg length in this zone [m]	0																																
Night cooling maximum hours [hours/month]	-																																
Night cooling maximum air flow rate [l/s.m2]	-																																
SFP for night cooling [W/(l/s)]	-																																
Shell & core <table><tr><td colspan="2">Shell area for fit-out</td><td>NO</td></tr></table>				Shell area for fit-out		NO																											
				Shell area for fit-out		NO																											
				Shell area for fit-out		NO																											

Windows & rooflights							
(Multiplier) Name	(1) z0/08 reception/s/g	(1) z0/08 reception/e/g	Notes				
In envelope	z0/08 reception/s	z0/08 reception/e					
Area [m2]	11.5	15.7					
Glazing name	Windows	Windows					
Shading position	None (no shading)	None (no shading)					
Shading colour	-	-					
Shading translucency	-	-					
Transmission factor	1	1					
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7					

Zone name: z1/01 hub offices		Activity: Generic Office Area		Multiplier: 1	
Area [m2]: 203		Height [m]: 3.8		Air permeability @ 50pa [m3/hm2]: 2	

HVAC system, ventilation, and exhaust												General Lighting and controls				Display lighting			
Name		VRF Heating & Cooling										Total wattage [W]		-		Efficient lamps		NO	
Destratification fans		NO										Design illuminance [Lux]		-		Lumens per circuit wattage		-	
Ventilation type		Mechanical										Lamp and ballast efficacy [Lumens/W]		120		Time switching		NO	
SFP for local mechanical supply & extract [W/(l/s)]		1.2										Light output ratio		1					
Heat Recovery system		Plate heat exchanger (Recuperator)										Lamp type		-					
Heat recovery seasonal efficiency		0.75										Air-extracting luminaires		NO					
Variable heat recovery efficiency		YES										Controls		BOTH					
Local mechanical exhaust		NO										Type of photoelectric control		PH-DIMMING					
Exhaust air flow rate [l/s.m2]		-										Different sensor for back of zone		NO					
SFP for mechanical exhaust [W/(l/s)]		-										Photoelectric control parasitic power [W/m2]		0.05					
Exhaust fans location		-										Automatic zoning for daylight		YES					
SFP for system terminal units [W/(l/s)]		-										Occupancy sensing		AUTO-ON-OFF					
Demand-controlled ventilation		None										Occupancy sensing parasitic power [W/m2]		0.05					
Flow regulation type for ventilation control		-																	
Night cooling maximum hours [hours/month]		-																	
Night cooling maximum air flow rate [l/s.m2]		-																	
SFP for night cooling [W/(l/s)]		-																	
												Hot water system							
Name												Local Hot Water Heaters							
Dead leg length in this zone [m]		0																	
												Shell & core							
Shell area for fit-out												NO							

Envelopes							
(Multiplier) Name	(1) z1/01 hub offices/si	(1) z1/01 hub offices/e	(1) z1/01 hub offices/n	(1) z1/01 hub offices/w	(1) z1/01 hub offices/c	(1) z1/01 hub offices/fi	
Type	Wall	Wall	Wall	Wall	Fiat roof	Floor or Ceiling	
Area [m2]	36.86	33.82	67.64	54	203	203	
Orientation	South	East	North	West	Horizontal	Horizontal	
Adjacent space	Unheated	Exterior	Exterior	Exterior	Exterior	Conditioned	
Construction name	Warehouse / Office Wall	External Cladding	External Cladding	External Cladding	Hub Office Roof	Internal Office floor	

Windows & rooflights							
(Multiplier) Name	(1) z1/01 hub offices/e/g	(1) z1/01 hub offices/n/g	(1) z1/01 hub offices/w/g				
In envelope	z1/01 hub offices/e	z1/01 hub offices/n	z1/01 hub offices/w				
Area [m2]	9.5	26.24	11.04				
Glazing name	Windows	Windows	Windows				
Shading position	None (no shading)	None (no shading)	None (no shading)				
Shading colour	-	-	-				
Shading translucency	-	-	-				
Transmission factor	1	1	1				
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7	0.2 / 0.7				

Notes

Zone name: z1/04 main office		Activity: Generic Office Area		Multiplier: 1	
Area [m2]: 382		Height [m]: 4		Air permeability @ 50pa [m3/hm2]: 2	

HVAC system, ventilation, and exhaust					
Name	VRF Heating & Cooling				
Destratification fans	NO				
Ventilation type	Mechanical				
SFP for local mechanical supply & extract [W/(l/s)]	1.2				
Heat Recovery system	Plate heat exchanger (Recuperator)				
Heat recovery seasonal efficiency	0.75				
Variable heat recovery efficiency	YES				
Local mechanical exhaust	NO				
Exhaust air flow rate [l/s.m2]	-				
SFP for mechanical exhaust [W/(l/s)]	-				
Exhaust fans location	-				
SFP for system terminal units [W/(l/s)]	-				
Demand-controlled ventilation	None				
Flow regulation type for ventilation control	-				
Night cooling maximum hours [hours/month]	-				
Night cooling maximum air flow rate [l/s.m2]	-				
SFP for night cooling [W/(l/s)]	-				

General Lighting and controls					
Total wattage [W]	-				
Design illuminance [Lux]	-				
Lamp and ballast efficacy [lumens/W]	120				
Light output ratio	1				
Lamp type	-				
Air-extracting luminaires	NO				
Controls	BOTH				
Type of photoelectric control	PH-DIMMING				
Different sensor for back of zone	NO				
Photoelectric control parasitic power [W/m2]	0.05				
Automatic zoning for daylight	YES				
Occupancy sensing	AUTO-ON-OFF				
Occupancy sensing parasitic power [W/m2]	0.05				

Hot water system	
Name	Local Hot Water Heaters
Dead leg length in this zone [m]	0

Shell & core	
Shell area for fit-out	NO

Envelopes					
(Multiplier) Name	(1) z1/04 main office/s	(1) z1/04 main office/ei	(1) z1/04 main office/ni	(1) z1/04 main office/wi	(1) z1/04 main office/ci
Type	Wall	Wall	Wall	Wall	Floor or Ceiling
Area [m2]	150.4	40.8	150.4	40.8	382
Orientation	South	East	North	West	Horizontal
Adjacent space	Exterior	Conditioned	Unheated	Conditioned	Conditioned
Construction name	External Cladding	Block Wall	Warehouse / Office Wall	Warehouse / Office Wall	Internal Office floor

Windows & rooflights	
(Multiplier) Name	(5) z1/04 main office/s/g
In envelope	z1/04 main office/s
Area [m2]	10.9
Glazing name	Windows
Shading position	None (no shading)
Shading colour	-
Shading translucency	-
Transmission factor	1
Frame / Aspect ratios	0.2 / 0.7

Notes

Zone name: z1/06 main stairs		Activity: Circulation area (corridors and stairways)		Multiplier: 1	
Area [m2]: 51		Height [m]: 4		Air permeability @ 50pa [m3/hm2]: 2	

HVAC system, ventilation, and exhaust										General Lighting and controls				Display lighting					
Name		VRF Heating & Cooling								Total wattage [W]		-		Efficient lamps		NO			
Destratification fans		NO								Design illuminance [Lux]		-		Lumens per circuit wattage		-			
Ventilation type		Natural								Lamp and ballast efficacy [Lumens/W]		110		Time switching		NO			
SFP for local mechanical supply & extract [W/(l/s)]		-								Light output ratio		1							
Heat Recovery system		-								Lamp type		-							
Heat recovery seasonal efficiency		-								Air-extracting luminaires		NO							
Variable heat recovery efficiency		-								Controls		BOTH							
Local mechanical exhaust		NO								Type of photoelectric control		PH-SWITCHING							
Exhaust air flow rate [l/s.m2]		-								Different sensor for back of zone		NO							
SFP for mechanical exhaust [W/(l/s)]		-								Photoelectric control parasitic power [W/m2]		0.05							
Exhaust fans location		-								Automatic zoning for daylight		YES							
SFP for system terminal units [W/(l/s)]		-								Occupancy sensing		AUTO-ON-OFF							
Demand-controlled ventilation		None								Occupancy sensing parasitic power [W/m2]		0.05							
Flow regulation type for ventilation control		-																	
Night cooling maximum hours [hours/month]		-																	
Night cooling maximum air flow rate [l/s.m2]		-																	
SFP for night cooling [W/(l/s)]		-																	

Envelopes									
(Multiplier) Name	(1) z1/06 main stairs/s	(1) z1/06 main stairs/e	(1) z1/06 main stairs/ni	(1) z1/06 main stairs/wi	(1) z1/06 main stairs/ci	(1) z1/06 main stairs/fi			
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling			
Area [m2]	30.8	34	30.8	24.4	51	51			
Orientation	South	East	North	West	Horizontal	Horizontal			
Adjacent space	Exterior	Exterior	Unheated	Unheated	Conditioned	Conditioned			
Construction name	External Cladding	External Cladding	Warehouse / Office Wall	Warehouse / Office Wall	Internal Office floor	Internal Office floor			

Windows & rooflights									
(Multiplier) Name	(1) z1/06 main stairs/s/g	(1) z1/06 main stairs/e/g							
In envelope	z1/06 main stairs/s	z1/06 main stairs/e							
Area [m2]	11.5	15.7							
Glazing name	Windows	Windows							
Shading position	None (no shading)	None (no shading)							
Shading colour	-	-							
Shading translucency	-	-							
Transmission factor	1	1							
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7							

Notes

HVAC system, ventilation, and exhaust									
Name	VRF Heating & Cooling								
Destratification fans	NO								
Ventilation type	Mechanical								
SFP for local mechanical supply & extract [W/(l/s)]	1.2								
Heat Recovery system	Plate heat exchanger (Recuperator)								
Heat recovery seasonal efficiency	0.75								
Variable heat recovery efficiency	YES								
Local mechanical exhaust	NO								
Exhaust air flow rate [l/s.m2]	-								
SFP for mechanical exhaust [W/(l/s)]	-								
Exhaust fans location	-								
SFP for system terminal units [W/(l/s)]	-								
Demand-controlled ventilation	None								
Flow regulation type for ventilation control	-								
Night cooling maximum hours [hours/month]	-								
Night cooling maximum air flow rate [l/s.m2]	-								
SFP for night cooling [W/(l/s)]	-								

General Lighting and controls		
Total wattage [W]	-	
Design illuminance [Lux]	-	
Lamp and ballast efficacy [lumens/W]	120	
Light output ratio	1	
Lamp type	-	
Air-extracting luminaires	NO	
Controls	BOTH	
Type of photoelectric control	PH-DIMMING	
Different sensor for back of zone	NO	
Photoelectric control parasitic power [W/m2]	0.05	
Automatic zoning for daylight	YES	
Occupancy sensing	AUTO-ON-OFF	
Occupancy sensing parasitic power [W/m2]	0.05	

Hot water system		
Name	Local Hot Water Heaters	
Dead leg length in this zone [m]	0	

Display lighting			
Efficient lamps	NO		
Lumens per circuit wattage	-		
Time switching	NO		

Thermal bridges Psi values [W/mK]			
Junction type	Metal clad	Not metal clad	
Roof-wall	0.02		0.18
Wall-ground floor	0.75		0.24
Wall-wall (corner)	0.02		0.135
Wall-not ground floor	0		0.11
Lintel (window/door)	0.05		0.45
Sill (window)	0.05		0.08
Jamb (window/door)	0.05		0.09

Shell & core	
Shell area for fit-out	NO

Envelopes					
(Multiplier) Name	(1) z2/01 main office/s	(1) z2/01 main office/ei	(1) z2/01 main office/ni	(1) z2/01 main office/wi	(1) z2/01 main office/ci
Type	Wall	Wall	Wall	Wall	Floor or Ceiling
Area [m2]	150.4	40.8	150.4	40.8	382
Orientation	South	East	North	West	Horizontal
Adjacent space	Exterior	Conditioned	Unheated	Unheated	Conditioned
Construction name	External Cladding	Block Wall	Warehouse / Office Wall	Warehouse / Office Wall	Internal Office floor

Windows & rooflights	
(Multiplier) Name	(5) z2/01 main office/s/g
In envelope	z2/01 main office/s
Area [m2]	10.9
Glazing name	Windows
Shading position	None (no shading)
Shading colour	-
Shading translucency	-
Transmission factor	1
Frame / Aspect ratios	0.2 / 0.7

Zone name: z2/03 main stairs	Activity: Circulation area (corridors and stairways)	Multiplier: 1
Area [m2]: 51	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting							
Name	VRF Heating & Cooling			Total wattage [W]	-			Efficient lamps	NO						
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-						
Ventilation type	Natural			Lamp and ballast efficacy [lumens/W]	110			Time switching	NO						
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1										
Heat Recovery system	-			Lamp type	-										
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO										
Variable heat recovery efficiency	-			Controls	BOTH										
Local mechanical exhaust	NO			Type of photoelectric control	PH-SWITCHING										
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	NO										
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	0.05										
Exhaust fans location	-			Automatic zoning for daylight	YES										
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF										
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.05										
Flow regulation type for ventilation control	-														
Night cooling maximum hours [hours/month]	-														
Night cooling maximum air flow rate [l/s.m2]	-														
SFP for night cooling [W/(l/s)]	-														

Thermal bridges Psi values [W/mK]			
Junction type	Metal clad	Not metal clad	
Roof-wall	0.02		0.18
Wall-ground floor	0.75		0.24
Wall-wall (corner)	0.02		0.135
Wall-not ground floor	0		0.11
Lintel (window/door)	0.05		0.45
Sill (window)	0.05		0.08
Jamb (window/door)	0.05		0.09

Shell & core	
Shell area for fit-out	NO

Envelopes							
(Multiplier) Name	(1) z2/03 main stairs/s	(1) z2/03 main stairs/e	(1) z2/03 main stairs/ni	(1) z2/03 main stairs/wi	(1) z2/03 main stairs/ci	(1) z2/03 main stairs/fi	
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling	
Area [m2]	30.8	34	30.8	24.4	51	51	
Orientation	South	East	North	West	Horizontal	Horizontal	
Adjacent space	Exterior	Exterior	Unheated	Unheated	Unheated	Conditioned	
Construction name	External Cladding	External Cladding	Warehouse / Office Wall	Warehouse / Office Wall	Office lid ceiling	Internal Office floor	

Windows & rooflights							
(Multiplier) Name	(1) z2/03 main stairs/s/g	(1) z2/03 main stairs/e/g					
In envelope	z2/03 main stairs/s	z2/03 main stairs/e					
Area [m2]	11.5	15.7					
Glazing name	Windows	Windows					
Shading position	None (no shading)	None (no shading)					
Shading colour	-	-					
Shading translucency	-	-					
Transmission factor	1	1					
Frame / Aspect ratios	0.2 / 0.7	0.2 / 0.7					

Notes

Zone name: z0/03 hub stairs	Activity: Circulation area (corridors and stairways)	Multiplier: 1
Area [m2]: 42	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust			General Lighting and controls			Display lighting		
Name	Electric Panels		Total wattage [W]	-	Efficient lamps	NO		
Destratification fans	NO		Design illuminance [Lux]	-	Lumens per circuit wattage	-		
Ventilation type	Natural		Lamp and ballast efficacy [Lumens/W]	110	Time switching	NO		
SFP for local mechanical supply & extract [W/(l/s)]	-		Light output ratio	1				
Heat Recovery system	-		Lamp type	-				
Heat recovery seasonal efficiency	-		Air-extracting luminaires	NO				
Variable heat recovery efficiency	-		Controls	MANUAL				
Local mechanical exhaust	NO		Type of photoelectric control					
Exhaust air flow rate [l/s m2]	-		Different sensor for back of zone	-				
SFP for mechanical exhaust [W/(l/s)]	-		Photoelectric control parasitic power [W/m2]	-				
Exhaust fans location	-		Automatic zoning for daylight	YES				
SFP for system terminal units [W/(l/s)]	-		Occupancy sensing	AUTO-ON-OFF				
Demand-controlled ventilation	None		Occupancy sensing parasitic power [W/m2]	0.2				

	-	Night cooling maximum hours [hours/month]		
	-	Night cooling maximum air flow rate [l/s.m ²]	Name	Local Hot Water Heaters
Hot water system			Shell & core	
			Shell area for fit-out	NO

Envelopes						
(Multiplier) Name	(1) z0/03 hub stairs/si	(1) z0/03 hub stairs/e	(1) z0/03 hub stairs/ni	(1) z0/03 hub stairs/wi	(1) z0/03 hub stairs/ci	(1) z0/03 hub stairs/f
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	33.2	8	33.2	21.6	42	42
Orientation	South	East	North	West	Horizontal	Horizontal
Adjacent space	Unheated	Exterior	Conditioned	Conditioned	Conditioned	Underground
Construction name	Warehouse / Office Wall	External Cladding	Block Wall	Block Wall	Internal Office floor	Ground Floor

Notes

Zone name: z0/04 hub toilets		Activity: Toilet	Multiplier: 1
Area [m2]: 12		Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting																													
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO																												
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-																												
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO																												
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1			Thermal bridges Psi values [W/mK] <table><tr><th>Junction type</th><th>Metal clad</th><th>Not metal clad</th></tr><tr><td>Roof-wall</td><td>0.02</td><td>0.18</td></tr><tr><td>Wall-ground floor</td><td>0.75</td><td>0.24</td></tr><tr><td>Wall-wall (corner)</td><td>0.02</td><td>0.135</td></tr><tr><td>Wall-not ground floor</td><td>0</td><td>0.11</td></tr><tr><td>Lintel (window/door)</td><td>0.05</td><td>0.45</td></tr><tr><td>Sill (window)</td><td>0.05</td><td>0.08</td></tr><tr><td>Jamb (window/door)</td><td>0.05</td><td>0.09</td></tr></table>						Junction type	Metal clad	Not metal clad	Roof-wall	0.02	0.18	Wall-ground floor	0.75	0.24	Wall-wall (corner)	0.02	0.135	Wall-not ground floor	0	0.11	Lintel (window/door)	0.05	0.45	Sill (window)	0.05	0.08	Jamb (window/door)	0.05	0.09
Junction type	Metal clad	Not metal clad																																			
Roof-wall	0.02	0.18																																			
Wall-ground floor	0.75	0.24																																			
Wall-wall (corner)	0.02	0.135																																			
Wall-not ground floor	0	0.11																																			
Lintel (window/door)	0.05	0.45																																			
Sill (window)	0.05	0.08																																			
Jamb (window/door)	0.05	0.09																																			
Heat Recovery system	-			Lamp type	-																																
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO																																
Variable heat recovery efficiency	-			Controls	MANUAL																																
Local mechanical exhaust	YES			Type of photoelectric control	-																																
Exhaust air flow rate [l/s.m2]	5			Different sensor for back of zone	-																																
SFP for mechanical exhaust [W/(l/s)]	0.4			Photoelectric control parasitic power [W/m2]	-																																
Exhaust fans location	Fan remote from zone			Automatic zoning for daylight	YES																																
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF																																
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2																																
Flow regulation type for ventilation control	-			Hot water system <table><tr><td>Name</td><td>Local Hot Water Heaters</td></tr><tr><td>Dead leg length in this zone [m]</td><td>2</td></tr></table>							Name	Local Hot Water Heaters	Dead leg length in this zone [m]	2																							
Name	Local Hot Water Heaters																																				
Dead leg length in this zone [m]	2																																				
Night cooling maximum hours [hours/month]	-																																				
Night cooling maximum air flow rate [l/s.m2]	-																																				
SFP for night cooling [W/(l/s)]	-																																				
Envelopes																																					
(Multiplier) Name	(1) z0/04 hub toilets/si	(1) z0/04 hub toilets/e	(1) z0/04 hub toilets/ni	(1) z0/04 hub toilets/wi	(1) z0/04 hub toilets/ci	(1) z0/04 hub toilets/f																															
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling																															
Area [m2]	19.6	9.6	19.6	9.6	12	12																															
Orientation	South	East	North	West	Horizontal	Horizontal																															
Adjacent space	Unheated	Exterior	Conditioned	Conditioned	Conditioned	Underground																															
Construction name	Warehouse / Office Wall																																				
Shell & core																																					
Shell area for fit-out									NO																												

Notes

Zone name: z0/04a hub toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 4	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust			General Lighting and controls			Display lighting		
Name	Electric Panels		Total wattage [W]	-	Efficient lamps	NO		
Destratification fans	NO		Design illuminance [Lux]	-	Lumens per circuit wattage	-		
Ventilation type	Natural		Lamp and ballast efficacy [Lumens/W]	110	Time switching	NO		
SFP for local mechanical supply & extract [W/(l/s)]	-		Light output ratio	1				
Heat Recovery system	-		Lamp type	-				
Heat recovery seasonal efficiency	-		Air-extracting luminaires	NO				
Variable heat recovery efficiency	-		Controls	MANUAL				
Local mechanical exhaust	YES		Type of photoelectric control					
Exhaust air flow rate [l/s.m2]	5		Different sensor for back of zone	-				
SFP for mechanical exhaust [W/(l/s)]	0.4		Photoelectric control parasitic power [W/m2]	-				
Exhaust fans location	Fan remote from zone		Automatic zoning for daylight	YES				
SFP for system terminal units [W/(l/s)]	-		Occupancy sensing	AUTO-ON-OFF				
Demand-controlled ventilation	None		Occupancy sensing parasitic power [W/m2]	0.2				

	-	Night cooling maximum hours [hours/month]	Hot water system		
	-	Night cooling maximum air flow rate [l/s.m ²]	Name	Local Hot Water Heaters	
Shell & core					
			Shell area for fit-out	NO	

Envelopes						
(Multiplier) Name	(1) z0/04a hub toilets/s/i	(1) z0/04a hub toilets/e/i	(1) z0/04a hub toilets/n/i	(1) z0/04a hub toilets/w/i	(1) z0/04a hub toilets/c/i	(1) z0/04a hub toilets/f
Type	Wall	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling
Area [m2]	6.4	6.4	6.4	9.6	4	4
Orientation	South	East	North	West	Horizontal	Horizontal
Adjacent space	Unheated	Conditioned	Conditioned	Conditioned	Conditioned	Underground
Construction name	Warehouse / Office Wall	Block Wall	Block Wall	Block Wall	Internal Office floor	Ground Floor

Notes

Zone name: z0/06 main toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 8	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting					
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO				
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-				
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO				
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1								
Heat Recovery system	-			Lamp type	-								
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO								
Variable heat recovery efficiency	-			Controls	MANUAL								
Local mechanical exhaust	YES			Type of photoelectric control	-								
Exhaust air flow rate [l/s.m2]	5			Different sensor for back of zone	-								
SFP for mechanical exhaust [W/(l/s)]	0.4			Photoelectric control parasitic power [W/m2]	-								
Exhaust fans location	Fan remote from zone			Automatic zoning for daylight	YES								
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF								
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2								
Flow regulation type for ventilation control													
Night cooling maximum hours [hours/month]	-												
Night cooling maximum air flow rate [l/s.m2]	-												
SFP for night cooling [W/(l/s)]	-												
				Hot water system									
Name		Local Hot Water Heaters											
Dead leg length in this zone [m]		2											
Thermal bridges Psi values [W/mK]													
Junction type				Metal clad				Not metal clad					
Roof-wall				0.02				0.18					
Wall-ground floor				0.75				0.24					
Wall-wall (corner)				0.02				0.135					
Wall-not ground floor				0				0.11					
Lintel (window/door)				0.05				0.45					
Sill (window)				0.05				0.08					
Jamb (window/door)				0.05				0.09					
Shell & core													
Shell area for fit-out				NO									

Envelopes						
(Multiplier) Name	(1) z0/06 main toilets/si	(1) z0/06 main toilets/el	(1) z0/06 main toilets/wi	(1) z0/06 main toilets/di	(1) z0/06 main toilets/f	
Type	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling	
Area [m2]	10.4	10.8	10.4	8	8	
Orientation	South	East	North	Horizontal	Horizontal	
Adjacent space	Conditioned	Conditioned	Unheated	Conditioned	Underground	
Construction name	Block Wall	Block Wall	Warehouse / Office Wall	Internal Office floor	Ground Floor	

Notes

Zone name: z1/02 hub stairs	Activity: Circulation area (corridors and stairways)	Multiplier: 1
Area [m2]: 42	Height [m]: 3.8	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting					
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO				
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-				
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO				
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1								
Heat Recovery system	-			Lamp type	-								
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO								
Variable heat recovery efficiency	-			Controls	MANUAL								
Local mechanical exhaust	NO			Type of photoelectric control	-								
Exhaust air flow rate [l/s.m2]	-			Different sensor for back of zone	-								
SFP for mechanical exhaust [W/(l/s)]	-			Photoelectric control parasitic power [W/m2]	-								
Exhaust fans location	-			Automatic zoning for daylight	YES								
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF								
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2								
Flow regulation type for ventilation control	-												
Night cooling maximum hours [hours/month]	-												
Night cooling maximum air flow rate [l/s.m2]	-												
SFP for night cooling [W/(l/s)]	-												

Envelopes							
(Multiplier) Name	(1) z1/02 hub stairs/si	(1) z1/02 hub stairs/e	(1) z1/02 hub stairs/ni	(1) z1/02 hub stairs/wi	(1) z1/02 hub stairs/c	(1) z1/02 hub stairs/fi	
Type	Wall	Wall	Wall	Wall	Pitched roof	Floor or Ceiling	
Area [m2]	33.2	8	33.2	21.6	42	42	
Orientation	South	East	North	West	Horizontal	Horizontal	
Adjacent space	Unheated	Exterior	Conditioned	Conditioned	Exterior	Conditioned	
Construction name	Warehouse / Office Wall	External Cladding	Block Wall	Block Wall	Hub Office Roof	Internal Office floor	

Notes

Zone name: z1/03 hub toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 12	Height [m]: 3.8	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust			General Lighting and controls			Display lighting	
Name	Electric Panels		Total wattage [W]	-	Efficient lamps	NO	
Destratification fans	NO		Design illuminance [Lux]	-	Lumens per circuit wattage	-	
Ventilation type	Natural		Lamp and ballast efficacy [Lumens/W]	110	Time switching	NO	
SFP for local mechanical supply & extract [W/(l/s)]	-		Light output ratio	1			
Heat Recovery system	-		Lamp type	-			
Heat recovery seasonal efficiency	-		Air-extracting luminaires	NO			
Variable heat recovery efficiency	-		Controls	MANUAL			
Local mechanical exhaust	YES		Type of photoelectric control	-			
Exhaust air flow rate [l/s.m2]	5		Different sensor for back of zone	-			
SFP for mechanical exhaust [W/(l/s)]	0.4		Photoelectric control parasitic power [W/m2]	-			
Exhaust fans location	Fan remote from zone		Automatic zoning for daylight	YES			
SFP for system terminal units [W/(l/s)]	-		Occupancy sensing	AUTO-ON-OFF			
Demand-controlled ventilation	None		Occupancy sensing parasitic power [W/m2]	0.2			

Hot water system	
Name	Local Hot Water Heaters
Night cooling maximum hours [hours/month]	=
Night cooling maximum air flow rate [l/s.m ²]	=
Shell & core	
Shell area for fit-out	NO

Envelopes						
(Multiplier) Name	(1) z1/03 hub toilets/si	(1) z1/03 hub toilets/e	(1) z1/03 hub toilets/ni	(1) z1/03 hub toilets/wi	(1) z1/03 hub toilets/c	(1) z1/03 hub toilets/fi
Type	Wall	Wall	Wall	Wall	Flat roof	Floor or Ceiling
Area [m2]	19.6	9.6	19.6	9.6	12	12
Orientation	South	East	North	West	Horizontal	Horizontal
Adjacent space	Unheated	Exterior	Conditioned	Conditioned	Exterior	Conditioned
Construction name	Warehouse / Office Wall	External Cladding	Block Wall	Block Wall	Hub Office Roof	Internal Office floor

Notes

Zone name: z1/03a toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 4	Height [m]: 3.8	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting																													
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO																												
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-																												
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO																												
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1			Thermal bridges Psi values [W/mK] <table><tr><th>Junction type</th><th>Metal clad</th><th>Not metal clad</th></tr><tr><td>Roof-wall</td><td>0.02</td><td>0.18</td></tr><tr><td>Wall-ground floor</td><td>0.75</td><td>0.24</td></tr><tr><td>Wall-wall (corner)</td><td>0.02</td><td>0.135</td></tr><tr><td>Wall-not ground floor</td><td>0</td><td>0.11</td></tr><tr><td>Lintel (window/door)</td><td>0.05</td><td>0.45</td></tr><tr><td>Sill (window)</td><td>0.05</td><td>0.08</td></tr><tr><td>Jamb (window/door)</td><td>0.05</td><td>0.09</td></tr></table>						Junction type	Metal clad	Not metal clad	Roof-wall	0.02	0.18	Wall-ground floor	0.75	0.24	Wall-wall (corner)	0.02	0.135	Wall-not ground floor	0	0.11	Lintel (window/door)	0.05	0.45	Sill (window)	0.05	0.08	Jamb (window/door)	0.05	0.09
Junction type	Metal clad	Not metal clad																																			
Roof-wall	0.02	0.18																																			
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Sill (window)	0.05	0.08																																			
Jamb (window/door)	0.05	0.09																																			
Heat Recovery system	-			Lamp type	-																																
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO																																
Variable heat recovery efficiency	-			Controls	MANUAL																																
Local mechanical exhaust	YES			Type of photoelectric control	-																																
Exhaust air flow rate [l/s.m2]	5			Different sensor for back of zone	-																																
SFP for mechanical exhaust [W/(l/s)]	0.4			Photoelectric control parasitic power [W/m2]	-																																
Exhaust fans location	Fan remote from zone			Automatic zoning for daylight	YES																																
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF																																
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2																																

Hot water system	
Name	Local Hot Water Heaters
Dead leg length in this zone [m] 2	

Envelopes						
(Multiplier) Name	(1) z1/03a toilets/si	(1) z1/03a toilets/el	(1) z1/03a toilets/mi	(1) z1/03a toilets/wi	(1) z1/03a toilets/c	(1) z1/03a toilets/fi
Type	Wall	Wall	Wall	Wall	Fiat roof	Floor or Ceiling
Area [m2]	6.08	9.12	6.08	9.12	4	4
Orientation	South	East	North	West	Horizontal	Horizontal
Adjacent space	Unheated	Conditioned	Conditioned	Conditioned	Exterior	Conditioned
Construction name	Warehouse / Office Wall	Block Wall	Block Wall	Block Wall	Hub Office Roof	Internal Office floor

Notes

Zone name: z1/05 main toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 32	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting					
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO				
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-				
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO				
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1								
Heat Recovery system	-			Lamp type	-								
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO								
Variable heat recovery efficiency	-			Controls	MANUAL								
Local mechanical exhaust	YES			Type of photoelectric control	-								
Exhaust air flow rate [l/s.m2]	5			Different sensor for back of zone	-								
SFP for mechanical exhaust [W/(l/s)]	0.4			Photoelectric control parasitic power [W/m2]	-								
Exhaust fans location	Fan remote from zone			Automatic zoning for daylight	YES								
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF								
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2								
Flow regulation type for ventilation control													
Night cooling maximum hours [hours/month]	-												
Night cooling maximum air flow rate [l/s.m2]	-												
SFP for night cooling [W/(l/s)]	-												
				Hot water system									
Name		Local Hot Water Heaters											
Dead leg length in this zone [m]		2											
Thermal bridges Psi values [W/mK]													
Junction type				Metal clad				Not metal clad					
Roof-wall				0.02				0.18					
Wall-ground floor				0.75				0.24					
Wall-wall (corner)				0.02				0.135					
Wall-not ground floor				0				0.11					
Lintel (window/door)				0.05				0.45					
Sill (window)				0.05				0.08					
Jamb (window/door)				0.05				0.09					
Shell & core													
Shell area for fit-out								NO					

Envelopes							
(Multiplier) Name	(1) z1/05 main toilets/si	(1) z1/05 main toilets/el	(1) z1/05 main toilets/wi	(1) z1/05 main toilets/di	(1) z1/05 main toilets/fi		
Type	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling		
Area [m2]	10.4	10.8	10.4	32	32		
Orientation	South	East	North	Horizontal	Horizontal		
Adjacent space	Conditioned	Conditioned	Unheated	Conditioned	Conditioned		
Construction name	Block Wall	Block Wall	Warehouse / Office Wall	Internal Office floor	Internal Office floor		

Notes

Zone name: z2/02 main toilets	Activity: Toilet	Multiplier: 1
Area [m2]: 32	Height [m]: 4	Air permeability @ 50pa [m3/hm2]: 2

HVAC system, ventilation, and exhaust				General Lighting and controls				Display lighting					
Name	Electric Panels			Total wattage [W]	-			Efficient lamps	NO				
Destratification fans	NO			Design illuminance [Lux]	-			Lumens per circuit wattage	-				
Ventilation type	Natural			Lamp and ballast efficacy [Lumens/W]	110			Time switching	NO				
SFP for local mechanical supply & extract [W/(l/s)]	-			Light output ratio	1								
Heat Recovery system	-			Lamp type	-								
Heat recovery seasonal efficiency	-			Air-extracting luminaires	NO								
Variable heat recovery efficiency	-			Controls	MANUAL								
Local mechanical exhaust	YES			Type of photoelectric control	-								
Exhaust air flow rate [l/s.m2]	5			Different sensor for back of zone	-								
SFP for mechanical exhaust [W/(l/s)]	0.4			Photoelectric control parasitic power [W/m2]	-								
Exhaust fans location	Fan remote from zone			Automatic zoning for daylight	YES								
SFP for system terminal units [W/(l/s)]	-			Occupancy sensing	AUTO-ON-OFF								
Demand-controlled ventilation	None			Occupancy sensing parasitic power [W/m2]	0.2								
Flow regulation type for ventilation control													
Night cooling maximum hours [hours/month]	-												
Night cooling maximum air flow rate [l/s.m2]	-												
SFP for night cooling [W/(l/s)]	-												
				Hot water system									
Name		Local Hot Water Heaters											
Dead leg length in this zone [m]		2											
				Thermal bridges Psi values [W/mK]									
Junction type		Metal clad		Not metal clad									
Roof-wall		0.02		0.18									
Wall-ground floor		0.75		0.24									
Wall-wall (corner)		0.02		0.135									
Wall-not ground floor		0		0.11									
Lintel (window/door)		0.05		0.45									
Sill (window)		0.05		0.08									
Jamb (window/door)		0.05		0.09									
				Shell & core									
Shell area for fit-out		NO											

Envelopes							
(Multiplier) Name	(1) z2/02 main toilets/si	(1) z2/02 main toilets/el	(1) z2/02 main toilets/wi	(1) z2/02 main toilets/di	(1) z2/02 main toilets/fi		
Type	Wall	Wall	Wall	Floor or Ceiling	Floor or Ceiling		
Area [m2]	10.4	10.8	10.4	32	32		
Orientation	South	East	North	Horizontal	Horizontal		
Adjacent space	Conditioned	Conditioned	Unheated	Unheated	Conditioned		
Construction name	Block Wall	Block Wall	Warehouse / Office Wall	Office lid ceiling	Internal Office floor		

Notes

Flight

Sustainable compact surface or suspended linear LED highbay



PART NUMBER: FGWY24K



PRODUCT DESIGN

Product Colour White
Weight (KG) 4.6
Height (mm) 75

Length/Diameter (mm) 585
Cut Out (mm) N/A
Optical Material Polycarbonate

LIGHTING DATA

Output (lumens) 18173
Emergency Lumens N/A
Wattage 103.4
LL/CW 175.8
Optic (Light Distribution) Wide
LOR % 100
Colour Rendering (CRI) Ra 80
Light Source Colour 4000K
Colour Consistency Macadam (SDCM) 3

ULR % 0
Life (hrs) to L90B50 54K
Life (hrs) to L80B50 >100,K
Life (hrs) to L70B50 >100,K
LXXB50 35000 hrs 93
LXXB50 50000 hrs 90
LXXB50 75000 hrs 86
LXXB50 100000 hrs 82
SHR Max 1.72

TECHNICAL DATA

Lamp Type LED
Control Gear DALI LED Driver
Emergency Type N/A
Integral Controls N/A

Mounting Method Surface / Suspended
IP Rating IP20
Min. ambient temperature -20
Max. ambient temperature 40

ELECTRICAL DATA

Power Factor Full Load 0.98
Voltage 240V
Hertz 50/60Hz
Driver Qty 1

Electrical class 1
Min Dim % 1
Output Current Tolerance % 3
Output Current Ripple % 2

MAX NUMBER PER CIRCUIT BREAKER

MCB B10A 17
MCB B16A 22

MCB C10A 28
MCB C16A 36

POLAR CURVE

