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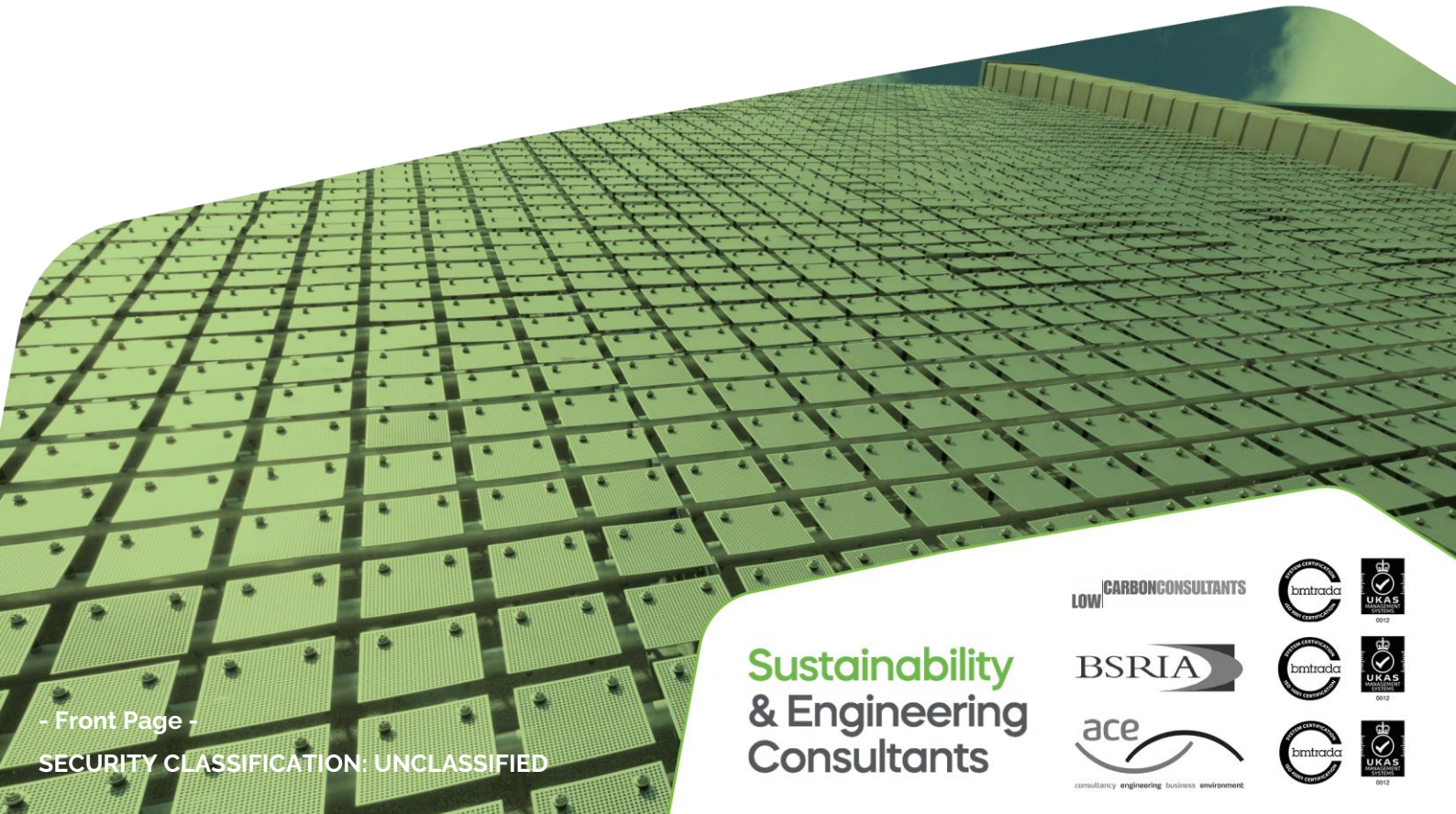
BERRITE INDUSTRIAL ESTATE

Building Modelling & Simulation

SBEM Report



Sustainability & Engineering Consultants

Sustainability & Engineering Consultants

Document information

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Sustainability & Engineering Consultants

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Suitability	Revision	Date	Description	Author / Checked	Approved
S2	P01	22/01/2025	First issue	SP/SD	EC
S2	P02	17/04/2025	Second Issue – Executive Summary updates	SP/TY	EC

CONTENTS

TABLES

FIGURES

1 Executive Summary

Services Design Solution (SDS) have been appointed by Berrite Limited to build a model of the proposed units 6-8 Berrite Estate, West Drayton, to establish compliance with Approved Document Part L – Conservation of the fuel and power, Volume 2: Buildings other than dwellings (2021 incorporating 2023 amendments – for use in England), hereafter ADL2 2021.

The report finds that using the proposed architectural and MEP designs outlined, the proposed **Berrite Units 6-8 achieves compliance with ADL2 2021.** Refer to Appendices A & B for the "As-Designed" BRUKL & EPC document output(s).

The Units 6-8 demonstrate compliance with ADL2 2021 Criterion 2 energy efficiency measures when using the fabric performance and fixed building services specification set out in this report.

The M&E philosophy is based on an electric strategy utilising a VRF heat pump system to provide space heating and cooling to the welfare areas. The shower, and toilet spaces are extracting warm air from the welfare areas. Lighting systems have been designed by SDS. Domestic Hot Water (DHW) is provided by electric point of use, with no storage.

To further comply with the London Borough of Hillingdon this proposed development requires Photovoltaic Panels on all three units. This ensures that the developments Building Emission Rate (BER) is less than zero. The development requires annual generation of circa 17,000 kWh/annum to achieve this. This can be seen in Appendix A & B.

The results shown in the report are draft "As-Designed" results and subject to further design changes. The results are based upon several assumptions which may affect the accuracy of the results.

2 Introduction

2.1 Purpose

The purpose of this report is to ascertain whether Berrite Units 6-8 complies with the requirements of Approved Document Part L – Conservation of fuel and power, Volume 2: Buildings other than dwellings (2021 incorporating 2023 amendments – for use in England), hereafter ADL2 2021.

This report does not examine any other energy efficiency requirements, e.g. local planning energy requirements.

2.2 Project Location

The proposed development is located at the Berrite Estate, West Drayton, Hillingdon. This site is surrounded by industrial buildings, there is minimal shading. The approximate site location is shown in red (Figure 1).

Figure 1: Site location highlighted in red.

2.3 Project Description

The proposed development includes three warehouse units. Unit 8 is detached while units 6-7 are joined.

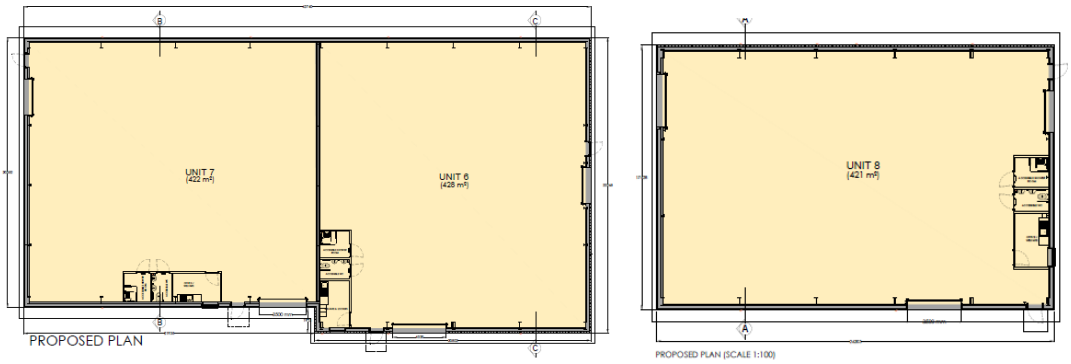


Figure 2: Proposed Floor Plan of Units 6-8

2.4 Software

For ADL2 2021, the approved methodologies or other software tools are approved under the Notice of Approval. A Dynamic Simulation Model (DSM) has been created using Integrated Environmental Solutions 'Virtual Environment' (IESVE) Version 2024.0.1.0, an advanced environmental modelling tool. The software also complies with CIBSE AM11:2015.

2.5 Limitations & Copyright

The recommendations of this report must be carefully reviewed to reflect changes as design proposals are developed.

This report is for the purposes of the interested parties relating to the project only and any third party that wishes. The specification and detail included throughout this report should be followed closely to retain the integrity of the results.

Refer to 8. Assumptions Register for methodology assumptions and risk.

3 Regulation & Policy Requirements

3.1 ADL2 2021

The Department of Levelling Up, Housing and Communities publishes guidance on ways to meet the Building Regulations called Approved Documents. ADL2 2021 establishes how energy efficient new or major refurbishments of non-domestic buildings in England should be.

A new non-domestic building must be built to the minimum standards of energy efficiency set out in ADL2 2021. This is evaluated by comparing performance calculations of the 'actual' building against performance calculations of a theoretical 'notional' building, carried out at design stage and when the building is constructed. The notional building is the same size and shape as the actual building, with standardised fabric performance and fixed building services.

The energy performance is described using the metrics 'Building Emission Rate' (BER, $kgCO_2/m^2/annum$) and 'Building Primary Energy Rate' (BPER, $kWh_{PE}/m^2/annum$) for the actual building, and 'Target Emission Rate' (TER, $kgCO_2/m^2/annum$) and 'Target Primary Energy Rate' (TPER, $kWh_{PE}/m^2/annum$) for the notional building.

To achieve compliance with ADL2 2021, the BER and BPER must at no point be greater than the TER and TPER. The specification of the actual building may vary from the notional, if the TER and TPER are not exceeded. Additionally, the following criteria must be satisfied:

- To ensure energy efficiency, the following heat gains and losses must be limited from (Criterion 2):
  - Thermal elements and other parts of building fabric (in the form of limiting U-values and air permeability), and;
  - Pipes, ducts, and vessels, used for space heating, cooling, and hot water services.
- Ensuring solar gains do not exceed set values within a given space (Criterion 3).
- Technical, environmental, and economic consideration given to high efficiency alternative systems where appropriate (Regulation 25A).

4 SBEM Model Specification

4.1 Model Images

Examples IESVE model image using IESVE 2024.0.1.0.

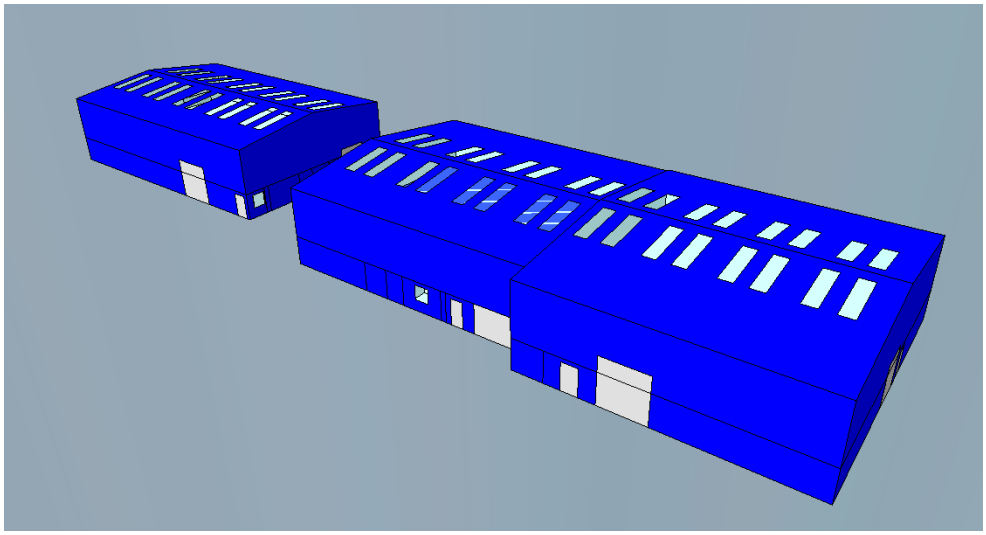


Figure 3: IESVE SBEM model, Units 6 - 8.

4.2 Scheme Design

The DSM has been based upon the architectural floor plans provided by AFA Architects

Table 1: Revit model register.

Drawing No.	Iteration	Date Received
SK71	-	April 2024
SK70	-	April 2024

4.3 Weather Data

SBEM & the National Calculation Methodology (NCM) state that CIBSE Test Reference Year (TRY) 2016 weather data sets must be used for ADL2 2021 compliance calculations. The most appropriate London CIBSE 2016 TRY weather file has been selected for the DSM.

4.4 Fabric Performance

Table 2 details the fabric performance used in the modelling simulation; the modelled fabric meets or exceeds the requirements of ADL2 2021 (Criterion 2).

Table 2: Fabric properties modelled.

Construction	U-value (W/m².K)	Notes
External wall	0.19	-
Ground floor	0.14	
External roof	0.14	
Windows (frame & glass)	1.60	g-value = 0.40; LT* = 70%
Rooflights	1.60	g-value = 0.40; LT* = 70%
Entrance door (pedestrian)	1.20	-
Vehicle Door	1.30	-
Air permeability	8 m^3/ ($hr.m^2$)	

*LT = Light Transmittance

4.5 Fixed Building Services

Table 3: Units 6-8 Berrite fixed building services modelled.

	Proposed M&E Specification	
HVAC	Variable Refrigerant Flow (VRF)	Heating SCoP = 4.30 Cooling SEER = 6.20
	Centralised & balanced Mechanical Ventilation with Heat Recovery (MVHR)	Ventilation SfP = 1.0 W/l/s Heat recovery = 75% Ventilation demand speed control (gas sensor)
	Extract Ventilation (Showers & Toilets)	Ventilation SfP = 0.4 W/l/s Heat recovery = 75% Always On
Lighting	Efficacies	SDS Lighting Design
	Lighting controls	Shower/Welfare/WC = AUTO-ON-OFF Main Area = MANUAL
DHW	Direct Electric (Point of Use)	Storage = No Delivery efficiency = 100%
Metering	Power factor correction	>0.95
	Metering provision	Metering with "Out-of-range" control linked to BMS
Renewables	PV annual generation – 17,250 kWh (this is the generation needed for all 3 units, spread over each roof)	

5 Results

5.1 ADL2 2021 Results

5.1.1 Criterion 1 & 2

The SBEM results for the proposed Units 6-8 **demonstrate compliance with ADL2 2021 Criterion 1**. Table 4 shows the "As-Designed" ADL2 2021 results, EPC score and asset rating.

Table 4: "As-Designed" BRUKL & EPC output.

"As-Designed" BRUKL & EPC Output	Units 6-8 Berrite
Modelled building floor area (m^2)	1331
Air permeability ($m^3/(h.m^2)$ @ 50Pa)	8
Building Emission Rate (BER, $kgCO_2/m^2$)	-0.23
Target Emission Rate (TER, $kgCO_2/m^2$)	2.22
Building Primary Energy Rate (BPER, kWh_{PE}/m^2)	-3.94
Target Primary Energy Rate (TPER, kWh_{PE}/m^2)	23.53
ADL2 2021 Criteria met?	**YES**
Projected EPC asset rating	**A+**
Projected EPC score	**-1**

5.1.2 Criterion 3

Solar gain compliance checks show that all the warehouse spaces do exceed the ADL2 2021, and as such are **compliant with ADL2 2021 (Criterion 3)**.

ADL2 2021 requires provisions to be made to limit internal temperature rise due to solar gain in the summer. Consideration should be given to window size and orientation, increased solar protection (low g-value, or external shading) and high thermal capacity.

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
07957- Berrite - unit 6 welfare	NO (-68.7%)	NO
07957- Berrite - unit 7 welfare	N/A	N/A
07957- Berrite - unit 8 welfare	N/A	N/A
07957- Berrite - unit 7 - main	YES (+44%)	NO
07957- Berrite - unit 8 - main	YES (+85.1%)	NO
07957- Berrite - unit 6 - main	YES (+46.5%)	NO

Figure 4: Solar gain exceedance on a room-by-room basis, BRUKL export.

5.1.3 Regulation 25A

Regulation 25A: Consideration of high efficiency alternative energy systems is satisfied through the specification of ASHPs for space heating.

6 Conclusions

The proposed units 6-8 **demonstrate compliance with ADL2 2021** of the UK Building Regulations (England) using the architectural and MEP proposals outlined in this report.

SDS conclude ADL2 2021 compliance is achieved for the proposed Berrite Industrial Units 6-8, as:

- The BER is equal to or less than the TER (Criterion 1)
- The BPER is equal to or less than the TPER (Criterion 2)
- Units 6-8 meets or exceeds the minimum energy efficiency requirements for fabric performance and fixed building services.
- Regulation 25A is met through the specification of ASHP.
- The SDS lighting design must be followed to ensure compliance with ADL2.
- PV annual generation of a minimum 17,250 kWh/annum across the 3 units.

The recommendations of this report must be carefully reviewed to reflect changes as design proposals are developed.

The results are subject to further design changes; the specification and detail included throughout this report should be followed closely to retain the integrity of the results.

7 Recommendations

SDS recommend the following measures to ensure compliance with ADL2 2021:

- Achieve the fabric performance specified in Table 2, which meets or betters the minimum requirements outlined in ADL2 2021.
- Provision of HVAC and fixed building services as detailed in the MEP design, meeting the efficiencies outlined in this report (as a minimum),
- Specification of low-zero-carbon/renewable technologies as outlined in this report to satisfy Regulation 25A.

8 Assumptions Register

There are several assumptions which have been made when undertaking the simulations presented. If any of these assumptions are incorrect, or should the parameters be varied throughout the evolution of the project design, then the simulations and calculations should be revisited to ensure the resultant outputs consider any updates.

Where the architectural design fails to comply with the assumption(s) stated or has been changed subsequently to this report without re-iteration, then the accuracy of this report is compromised, which may result in consequential non-compliance with the Client requirements and the Building Regulations.

Table 5: Assumptions register.

Item	Assumption	Reason/Limitation/Risk
1	Fabric performance (U-values & air permeability)	If the fabric performance differs from the values stated within this report, the risk of non-compliance with ADL2 2021 is significantly increased.
2	Fixed building services	If the fixed building services efficiencies differ from the values stated within this report, the risk of non-compliance with ADL2 2021 is significantly increased.

9 Bibliography

A BSRIA Guide: The Illustrated Guide to Ventilation. (Complied by Kevin Pennycook). (BSRIA BG 2/2009 – June 2010 Update). ISBN 978-0-86022-673-4.

CIBSE AM10. Natural Ventilation in Non-Domestic Buildings. Chartered Institute of Building Services Engineers. London. 2005. ISBN 1-903287-56-1.

CIBSE AM11. Building Performance Modelling. Chartered Institute of Building Services Engineers, London. 2015. ISBN 978-1-906846-67-1.

CIBSE Guide A: Environmental Design. . Chartered Institute of Building Services Engineers, London. 2015.

DSM software: IES Virtual Environment – Version 2024.0.1.0.

National Calculation Methodology, 2021 edition. NCM Modelling Guide (for buildings other than dwellings in England).

The Building Regulations 2010. Approved Document Part F – Volume 2: Buildings other than dwellings. Ventilation. (2021 edition – for use in England). HM Government. ISBN 978-1-914124-77-8.

The Building Regulations 2010. Approved Document Part L – Volume 2: Buildings other than dwellings. Conservation of fuel and power. (2021 edition incorporating 2023 amendments – for use in England). HM Government. ISBN 978-1-914124-79-2.

Weather file: CIBSE, in collaboration with UK Climate Impacts Programme (UKCIP).

APPENDIX A

"As-Designed" BRUKL Output

"As-Designed" BRUKL Output

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Berrite Units 6-8 GREEN AP 8 PV100 - SBEM — As designed

Date: Wed Jan 22 15:48:08 2025

Administrative information

Building Details

Address: Iron Bridge Road, Hillingdon, UB7 8HY

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.27

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.27

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 24.47

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	2.22	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	-0.23	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	23.53	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	-3.94	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.23	0.27	07000007:Surf[1]
Floors	0.18	0.14	0.14	07000006:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	07000002:Surf[9]
Windows** and roof windows	1.6	1.6	1.6	0700000E:Surf[1]
Rooflights***	2.2	1.6	1.6	07000002:Surf[1]
Personnel doors^	1.6	1.2	1.2	07000002:Surf[21]
Vehicle access & similar large doors	1.3	1.3	1.3	07000002:Surf[22]
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	8

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- MVHR unit - Berrite - Kitchenette _ Welfare

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.3	6.2	0	1	0.74
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- DHW - Berrite

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
07957- Berrite - unit 6 cupboard	65	-	-
07957- Berrite - unit 6 shower	69	-	-
07957- Berrite - unit 6 toilet	71	-	-
07957- Berrite - unit 6 welfare	166	-	-
07957- Berrite - unit 7 cupboard	64	-	-
07957- Berrite - unit 7 shower	67	-	-
07957- Berrite - unit 7 toilet	69	-	-
07957- Berrite - unit 7 welfare	159	-	-
07957- Berrite - unit 8 cupboard	64	-	-
07957- Berrite - unit 8 shower	69	-	-
07957- Berrite - unit 8 toilet	71	-	-
07957- Berrite - unit 8 welfare	164	-	-
07957- Berrite - unit 7 - main	161	-	-
07957- Berrite - unit 8 - main	168	-	-
07957- Berrite - unit 6 - main	161	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
07957- Berrite - unit 6 welfare	NO (-68.7%)	NO
07957- Berrite - unit 7 welfare	N/A	N/A
07957- Berrite - unit 8 welfare	N/A	N/A
07957- Berrite - unit 7 - main	YES (+44%)	NO
07957- Berrite - unit 8 - main	YES (+85.1%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
07957- Berrite - unit 6 - main	YES (+46.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	1331	1331
External area [m²]	3987.9	3987.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	8	5
Average conductance [W/K]	1109.04	1301.95
Average U-value [W/m²K]	0.28	0.33
Alpha value* [%]	25	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
100	**Storage or Distribution**
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	0.14	0.48
Cooling	0.09	0.14
Auxiliary	0.36	0.65
Lighting	5.34	10.51
Hot water	4.16	3.95
Equipment*	29.9	29.9
TOTAL**	10.09	15.73

* 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	12.96	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*12.96*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	3.37	7.16
Primary energy [kWh_{PE}/m²]	-3.94	23.53
Total emissions [kg/m²]	-0.23	2.22

APPENDIX B

"As-Designed" EPC Output

"As-Designed" EPC Output

Energy Performance Certificate

HM Government

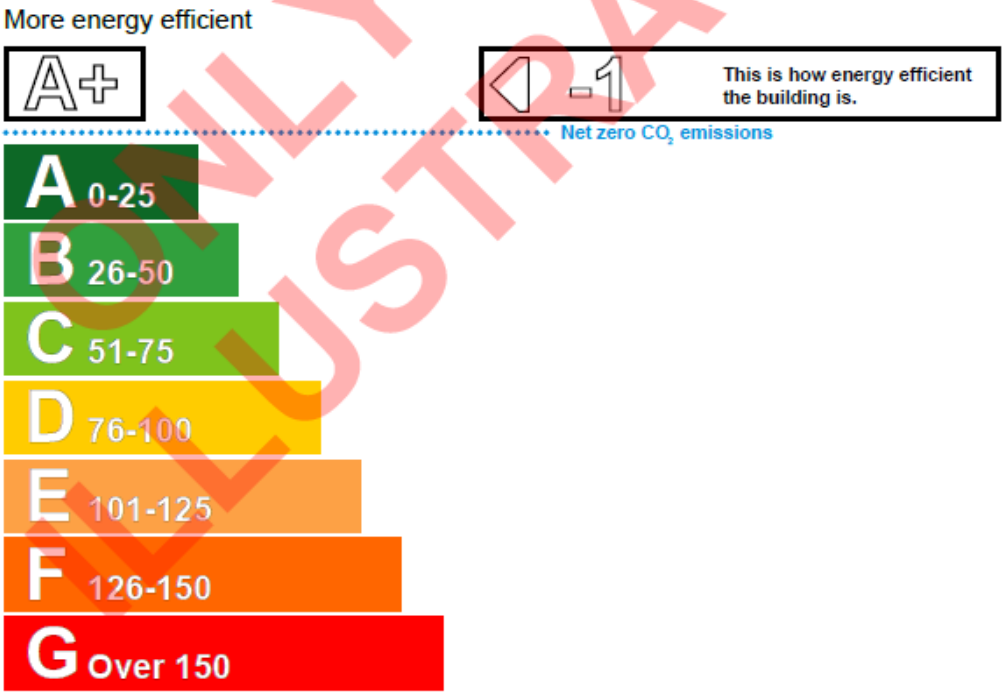
Non-Domestic Building

Iron Bridge Road
West Drayton
Address 3
Address 4
Hillingdon
UB7 8HY

Certificate Reference Number:
6509-2257-1722-6784-0869

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating



Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	1330.949
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	-0.23
Primary energy use (kWh_{PE}/m^2 per year):	-3.94

Benchmarks

Buildings similar to this one could have ratings as follows:

13 If newly built

51 If typical of the existing stock

Sustainability
& Engineering
Consultants

Services Design Solution Ltd
Building Services Consulting Engineers

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