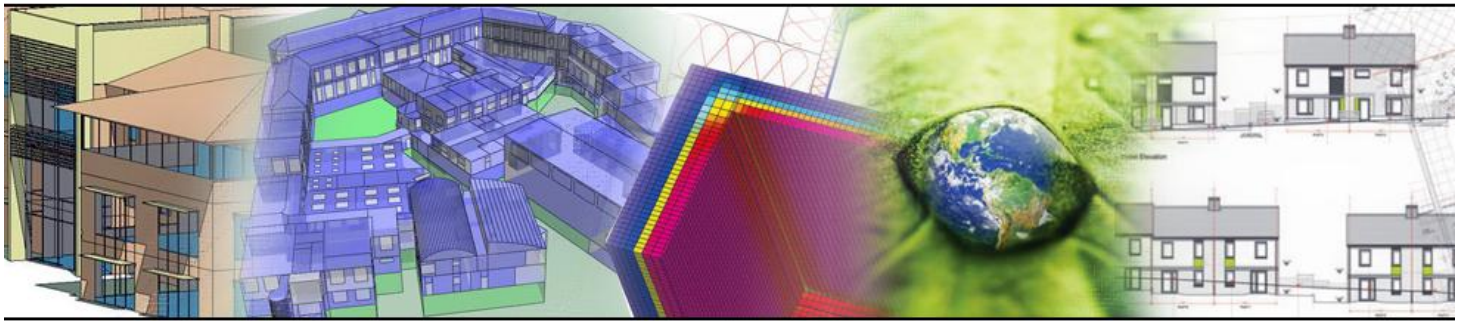




Part L2a Compliance Report

Dawley Distribution Park, Uxbridge,
London

'Shell & Core'
As Built

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1. Summary

Building Regulations: Part L2a: 2013 (Eng)

Assessment Methodology: Level 5 DSM

Software: IES-VE v2015

Prepared by		Checked by	
			
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Principal Sustainability Consultant		Sustainability Consultant	
Date: 20/11/2015		Date: 20/11/2015	
File reference:	06-15-52848 S2		

Version	Status	Date	Change Summary
S1	Design Stage	19/10/15	-
S2	As Built Stage	20/11/15	Air test and PV updated for as built stage



Registered office as above. Company reg. no. 4507219

2. Results

2.1. Criterion 1 – Achieving the BER

Results show the shell & core development has the potential to comply with the requirements of ADL2a Criterion 1; the Building Emission Rate is less than the Target Emission Rate.

In order to show compliance with the Energy and Sustainability Statement each unit has been simulated against the 2010 regulations both with and without the renewable contributions. From this a development site wide saving has been calculated against the 2010 Regulations.

2013 Regulations	Building area or, part	Unit A	Unit B	Unit C	Unit D	Unit E	
	Notional Emissions Rate	24.9	21.2	22.6	22.8	25.2	kg.CO ₂ /m ² /yr
	Target Emissions Rate (TER)	24.9	21.2	22.6	22.8	25.2	
	Building Emissions Rate (BER)	11.8	8.6	12.8	14.9	21.2	
	Compliance margin	52.6%	59.4%	48.3%	34.6%	15.9%	%
	Pass/Fail	PASS	PASS	PASS	PASS	PASS	
2010 Regulations	Building area or, part	Unit A	Unit B	Unit C	Unit D	Unit E	
	Target Emissions Rate (TER)	23.5	19.8	21.1	21.2	23.4	kg.CO ₂ /m ² /yr
	Building Emissions Rate (BER)	9.4	6.6	10.9	13.1	19.2	
	Compliance margin	60.0%	66.7%	48.3%	38.2%	17.9%	%
	Building Emissions Rate (BER) – No Renewables	21.8	17.0	19.3	18.0	n/a	kg.CO ₂ /m ² /yr
	Renewables Contribution	56.9%	61.2%	40.4%	27.2%	0.0%	%
	Pass/Fail	PASS	PASS	PASS	PASS	PASS	

Table 1. Criterion 1 summary

2010 Regulations	Building area or, part	Development site wide	
	Target Emissions Rate (TER)	109.0	kg.CO ₂ /m ² /yr
	Building Emissions Rate (BER)	59.2	
	Compliance margin	45.7%	%
	Building Emissions Rate (BER) – No Renewables	94.3	kg.CO ₂ /m ² /yr
	Renewables Contribution	37.2%	%
	Pass/Fail	PASS	

Table 2. Criterion 1 Development wide summary of savings against 2010 Regulations

Site wide the development is showing a predicted CO₂ saving against 2010 regulations of 45.7% and a renewables contribution of 37.2%. This meets the minimum requirements of the Energy and Sustainability Statement.

As-designed Part L documentation is intended to demonstrate to Building Control that the proposed design achieve the Part L compliance requirements prior to construction. Upon building completion or the first fit-out, the Part L model must be revised to represent the as-built and as-installed specification. The evidence requirements for the as-built calculation are provided within the appendix of this report.

2.2. Criterion 2 – Limits on Design Flexibility

Design limits are outlined within Approved Document Part L2a and Non-domestic Building Compliance Guide. The appended BRUKL document outlines the building performance against each of the respective design limits.

The following parameters exceed the recommended design limits;

Parameter	Proposed Value	Limiting Value
Vehicle door to Unit E	5.88 W / m ² K Assumed based on steel door with no insulation	1.5W / m ² K for Vehicle doors to heated spaces

Table 3. Criterion 2 non-compliance summary

It should be noted that Unit E has been modelled as a single shell space with no partitions internally. At this stage in order to assess the building it is assumed that this will be heated. However, it is possible that the future tenant will divide up the space and not be heating the warehouse space. Therefore this door would not be into a heated space and would not be required to be insulated. It is the tenants' responsibility to provide a fit out assessment based on their proposed fit out design.

2.3. Criterion 3 – Limiting the Effects of Solar Gain in Summer

The cumulative solar gain for all applicable zones has been calculated and compared against the recommended limits. The appended BRUKL document outlines all results.

All applicable zones comply with the requirements of Criterion 3

2.4. EPC Asset Rating

A preliminary EPC has been produced at this stage based upon the details outlined within this report.

Metric	Unit A	Unit B	Unit C	Unit D	Unit E
Asset Rating	13	10	15	17	21
Band	A	A	A	A	A

Table 4. EPC result

Upon practical completion of the first fit out stage, a final EPC must be produced to incorporate all as-built and as-installed performance information. This final EPC must be lodged onto the central Landmark register. All EPCs must be generated within the most recently Government approved software version irrespective of the version used for the Part L compliance assessment. Stroma cannot be held responsible for any variations within the EPC rating as a result of specification, software or, regulatory changes.

3. Building Regulations Summary

Part L2a: 2013 (England)

Approved Document Part L2a: 2013 came into force on 6th April 2014, superseding the former Part L2a: 2010. The 2013 Part L largely follows the same methodology as before with a number of key changes intended to reduce energy consumption and associated CO₂ emissions. The 2013 target emissions rate represents a 9% reduction in CO₂ emissions across an aggregated mix of non-domestic building types. This assessment considers the first 3 of 5 criteria, the key objectives of which are unchanged.

Criterion 1 – achieving the BER

Compliance is demonstrated where the Building Emission Rate (BER) is less than the Target Emission Rate (TER). Carbon dioxide emissions of the building are calculated using Government approved software encompassing the Architectural form, fabric and building services specifications. The TER is derived directly from the Notional building enabling a direct comparison between a compliant and the actual specification. A number of improvements have been made to the Notional building specification in order to achieve the targeted 9% reduction in CO₂ emissions.

Criterion 2 – limits on design flexibility

In order to guide the building specification towards higher levels of energy efficiency and in recognition of technical development, the minimum performance limits for building services have been improved. These are all set out within the 2013 Non-Domestic Building Services Compliance Guide. 'Backstop' or, 'limiting' U-values for building fabric and air permeability remain unchanged from 2010.

Criterion 3 – limiting the effects of solar gain in summer

Criterion 3 considers the cumulative solar gain for all occupied or mechanically cooled spaces. The objective is to steer design towards a reduction for the need or, the installed capacity of air conditioning systems. In order to demonstrate compliance, the solar gain aggregated over the period April to September must not exceed a limit derived for a room of the same size with a pre-defined area of glazing and glass specification. The respective solar gain limit is dependent upon whether the room type is considered 'top lit' or 'side lit'.

This development has been assessed by trained and accredited Energy Assessors using Government approved compliance software by Integrated Environmental Solutions (IES). This report details the basis of modelling and a summary of the results, including the BRUKL document included as an appendix.

Energy Performance Certificates must always be generated using the most up to date software version, in accordance with European legislation. Therefore, Stroma Technology cannot be held responsible for any change in result owing to building specification, legislative or software revisions.

4. Model Geometry

Architectural drawings have been provided by Ross Nolan of Marbank Construction Ltd on 09/10/15.

Drawing type	Drawing by	Drawing reference	Revision
Site Plan	Ian C King Associates and Architects	1620-10-1	F
Unit A	Ian C King Associates and Architects	1620-20-01	E
Units B-E Ground Floor	Ian C King Associates and Architects	1620-20-02	F
Units B-E First Floor	Ian C King Associates and Architects	1620-20-03	E
Units B-E Sections and Elevations	Ian C King Associates and Architects	1620-20-05	C

Table 5. Drawings used for model



Figure 1. IES thermal model

5. Thermal Envelope

Construction information has been provided by Ross Nolan of Marbank Construction Ltd on 14/10/15.

Opaque element	Construction (type and insulation)	U-value (W / m ² .K)	Metal Cladding	Assumption
Ground Floor - Unit A	Ground, Insulation, Reinforced Concrete	0.20	☐	☐
Ground Floor – Units B-E	Ground, Reinforced Concrete	0.16	☐	☐
External Wall existing upgraded Cladding	Steel, Insulation, Steel	0.21	☒	☐
External Wall – Existing upgraded brick	Brick, Cavity, Insulation, Block	0.21	☐	☐
External Wall – New Cladding	Steel, Insulation, Steel	0.21	☒	☐
Roof	Steel, Insulation, Steel	0.18	☒	☐
Personnel doors	Steel, Insulation, Steel	1.4	☐	☐
Vehicle doors - Units A-D	Steel, Insulation, Steel	1.5	☐	☐
Vehicle doors - Unit E	Steel	5.88	☐	☒
Spandrel Panels	Glass, Cavity, Glass	1.5	☐	☐

Table 6. Opaque building elements

Translucent element	Construction type	Overall U-value (W / m ² .K)	Solar g-value	Light trans.	Assumption
Windows	Double Glazed	1.5	0.6	0.6	☐
Rooflights	Triple glazed	1.3	0.58	0.65	☐

Table 7. Transparent building elements

Unit	Air permeability (m ³ /h.m ² @ 50 Pa)	Tested by	Date of test	Assumption
A	2.57	Build Check Ltd	11/11/15	☐
B, C, D & E	2.27	Build Check Ltd	11/11/15	☐

Table 8. Air infiltration

6. Mechanical and Electrical Services

6.1. Heating, Cooling and Ventilation

As the building is being constructed as shell and core the Mechanical and Electrical services have been assumed as follows:

	System reference:	01 - Warehouse - Flued forced convection Nat vent				
	Areas served:	Warehouses				
	Type:	Flued forced-convection air heaters				
Heating	Source:	Air heater	Fuel:	Natural gas	ECA	N/A
	Seasonal efficiency:	91 %	Heating circulator pump:	N/A		
	Provision for energy metering:	Yes	Alarms for 'out-of-range' values:	No		

Table 9. HVAC system parameters

	System reference:	02 - WC / Circulation - Electric				
	Areas served:	WC's and circulation				
	Type:	Other local room heater - unfanned				
Heating	Source:	Direct or storage electric heater	Fuel:	Grid supplied electricity	ECA	N/A
	Seasonal efficiency:	100 %	Heating circulator pump:	N/A		
	Provision for energy metering:	Yes	Alarms for 'out-of-range' values:	No		

Table 10. HVAC system parameters

	System reference:	03 - Office - VRF Mech Vent HR-60%				
	Areas served:	Office area				
	Type:	Split or multi-split system				
Heating	Source:	Heat pump (electric): air source	Fuel:	Grid supplied electricity	ECA	N/A
	Seasonal efficiency:	3.50	Heating circulator pump:	N/A		
Cooling	Source:	Heat pump (electric)			ECA	N/A
	Seasonal efficiency SEER:	4.00	Nominal Efficiency EER		3.50	
	Provision for energy metering:	Yes	Alarms for 'out-of-range' values:	No		

Table 11. HVAC system parameters

System reference:		04 - DHW electric instant					
Areas served:		All areas					
Type:		Instantaneous hot water only					
Efficiency:		100 %	Fuel:		Grid supplied electricity		
Storage volume:		None	Storage insulation or losses:			None	
Secondary circulation:	No	Loop length (m):	n/a	Losses (W/m):	n/a	Pump Power (kW):	n/a

Table 12. DHW system parameters

All assumptions (in red) must be reviewed by the design team and confirmed to Stroma Tech. Variations made to the input parameters are likely to change the overall Building Emissions Rate and therefore may lead to non-compliance.

6.2. Mechanical Ventilation

Mechanical ventilation details have not been provided at this stage because the building is shell and core. Therefore the following assumptions have been applied to the thermal model accordingly. Specific Fan Powers are reported within the appended BRUKL output document against the limiting value for each fan category.

Detail	Source	Assumption
Fan types	Assumed - refer to Appendix A	☒
Specific Fan Power	Assumed - refer to Appendix A	☒
Extract Flow Rate	Assumed - refer to Appendix A	☒

Table 13. Mechanical ventilation data source

All assumptions must be reviewed by the design team and confirmed to Stroma Tech. Variations made to the input parameters are likely to change the overall Building Emissions Rate and therefore may lead to non-compliance.

6.3. Internal Lighting

Internal lighting details have not been provided at this stage because the building is shell and core. Therefore the following assumptions have been applied to the thermal model accordingly.

Principal information format:

Luminaire specification - No calculations carried out

Detail	Information Source	Assumption
Luminaire Type/Performance	Assumed - refer to Appendix A	☒
Presence detection	Assumed - refer to Appendix A	☒
Daylight control	Assumed - refer to Appendix A	☒
Sensor parasitic power	Assumed - refer to Appendix A	☒

Table 14. Internal lighting details

All assumptions must be reviewed by the design team and confirmed to Stroma Tech. Variations made to the input parameters are likely to change the overall Building Emissions Rate and therefore may lead to non-compliance.

Model input parameters are tabulated within Appendix A of this report.

6.4. BMS and Power Factor Correction

A BMS facility will be installed to provide energy sub-metering.

A Power Factor Correction device will not or, has not been installed. Therefore, the default Factor of <0.9 has been applied.

7. Renewable Energy Technology

The following renewable energy technologies have been incorporated into the development:

Technology details have been provided by Richard Allsop of Marbank Construction Ltd on 20/11/15.

Technology	Size/Capacity	Location/Orientation
Unit A	18 kWp (117.135 m ²)	Unit Roof; 250° clockwise from North; 6° tilt angle
Unit B	48 kWp (312.361 m ²)	
Unit C	17 kWp (110.628 m ²)	
Unit D	11.5 kWp (74.846 m ²)	
Unit E	None	n/a

Table 15. Renewable energy technology

The PV panels have been modelled as per the details provided by Richard Allsop on the 20/11/15. The below has been based on the Perlight PLM-250P-60 Series Panel as specified.

Renewables

PVS generator Wind generator CHP generator

PV array type: Polycrystalline silicon

☒ Derive performance parameters from PV array type?

PV module nominal efficiency: 0.1537 Nominal cell temperature (NOCT) (°C): 45.0

Reference irradiance for NOCT (W/m2): 1000 Temperature coefficient for module efficiency (1/K): 0.0045

Degradation factor: 0.9900 Shading factor: 1.0000 Electrical conversion efficiency: 0.9700

	Area (m ²)	Azimuth (° clockwise from north)	Inclination (° from horizontal)
Unit A	117.135	250.0	6.0
Unit B	312.361	250.0	6.0
Unit C	110.628	250.0	6.0
Unit D	74.846	250.0	6.0

Add panel Remove panel

OK Cancel

Figure 2. PV arrays modelled

A Microgeneration Certification Scheme (MCS) certificate will be required for any installed renewable technology to fulfil the EPC evidence requirements.

Appendix A. Model Input Parameters

Room Name	Lighting and Controls														System		Mechanical Ventilation					
	Lamp Efficacy (lm / W)	Light Output Ratio (LOR)	Luminaire Efficacy (lm / W)	Display Lighting Uses Efficient Lamps?	Lamp Efficacy (lm)	Display Lighting Time Switching?	Daylight Control	Control Type	Sensor Type	Sensor Time- switch	Sensor Parasitic Power (W / m²)	Occupancy Sensing	Sensor Parasitic Power (W / m²)	Sensor Time- switch	Heating / Cooling / Vent System	Heating Plant Radiant Fraction	Extract	Flow Rate (ACH ⁻¹)	Specific Fan Power (W / (l/s))	Is fan remote from room?	Heat Recovery Type	Heat Recovery Seasonal Efficiency
U10001Warehouse	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	01 - Warehouse - Flued forced convection Nat ven	0	-	-	-	-	-	-
U10002Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U10003WC	60	1	60	-	-	-	-	-	-	-	-	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric extract	0.1	Yes	10	0.5	Fan remote from zone	-	-
U10101OfficeMezzanine	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	03 - Office - VRF Mech Vent HR-60%	0	-	Central SFP - 1.6W/(l/s)			Plate	0.6
U10102Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U20001Warehouse	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	01 - Warehouse - Flued forced convection Nat ven	0	-	-	-	-	-	-
U20002Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U20003WC	60	1	60	-	-	-	-	-	-	-	-	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric extract	0.1	Yes	10	0.5	Fan remote from zone	-	-
U20101OfficeMezzanine	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	03 - Office - VRF Mech Vent HR-60%	0	-	Central SFP - 1.6W/(l/s)			Plate	0.6
U20102Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U30001Warehouse	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	01 - Warehouse - Flued forced convection Nat ven	0	-	-	-	-	-	-
U30002Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U30003WC	60	1	60	-	-	-	-	-	-	-	-	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric extract	0.1	Yes	10	0.5	Fan remote from zone	-	-
U30101OfficeMezzanine	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	03 - Office - VRF Mech Vent HR-60%	0	-	Central SFP - 1.6W/(l/s)			Plate	0.6
U30102Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U40001Warehouse	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	01 - Warehouse - Flued forced convection Nat ven	0	-	-	-	-	-	-
U40002Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U40003WC	60	1	60	-	-	-	-	-	-	-	-	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric extract	0.1	Yes	10	0.5	Fan remote from zone	-	-
U40101OfficeMezzanine	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	03 - Office - VRF Mech Vent HR-60%	0	-	Central SFP - 1.6W/(l/s)			Plate	0.6
U40102Stairs	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	02 - WC / Circulation - Electric <from template>	0.1	-	-	-	-	-	-
U50001Warehouse	60	1	60	-	-	-	Yes	Switching	Standalone	No	0	AUTO-ON-OFF	0.1	No	01 - Warehouse - Flued forced convection Nat ven	0	-	-	-	-	-	-

Appendix B. BRUKL Output Document – Unit A-2013

Project name

Shell and Core

Unit A - S2 As Built - 2013 Regulations

As designed

Date: Fri Nov 20 15:43:01 2015

Administrative information

Building Details

Address: Unit A, HAYES , UB3 1DQ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJCriterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	24.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	24.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	11.8
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.21	0.21	10000002:Surf[1]
Floor	0.25	0.2	0.2	10000002:Surf[0]
Roof	0.25	0.18	0.18	10000008:Surf[3]
Windows***, roof windows, and rooflights	2.2	1.19	1.5	10000008:Surf[16]
Personnel doors	2.2	1.4	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	1.5	10000008:Surf[19]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.57

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.13	0	-
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

2- 02 - WC / Circulation - Electric extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.1	0	-
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

3- 01 - Warehouse - Flued forced convection Nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
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

4- 03 - Office - VRF Mech Vent HR-60%

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	0	0.6
Standard value	2.5*	3.2	N/A	N/A	0.5
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.					

1- 04 - DHW electric instant

	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"

Shell and core configuration

Zone	Assumed shell?
U10002Stairs	YES
U10003WC	YES
U10001Warehouse	YES
U10101OfficeMezzanine	YES
U10102Stairs	YES

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
U10002Stairs		-	60	-	84

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
U10003WC		-	60	-
U10001Warehouse		60	-	-
U10101OfficeMezzanine		60	-	-
U10102Stairs		-	60	-
				General lighting [W]
				111
				3957
				1458
				70

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?
U10001Warehouse	NO (-43.5%)	NO
U10101OfficeMezzanine	NO (-57.1%)	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]	666.5	666.5
External area [m ²]	1948.8	1948.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	504.55	657.59
Average U-value [W/m ² K]	0.26	0.34
Alpha value* [%]	10	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	22.65	45.48
Cooling	2.55	1.1
Auxiliary	1.74	1.16
Lighting	23.51	21.7
Hot water	4.32	4.51
Equipment*	32.35	32.35
TOTAL **	54.76	73.94

* Energy used by equipment does not count towards the total for 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	22.43	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]	106.71	176.49
Primary energy* [kWh/m ²]	143.05	147.37
Total emissions [kg/m ²]	11.8	24.9

* 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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	63.1	0	22.2	0	0	0.79	0	0.91	0
	Notional	152.1	0	49	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	273.9	0	95.1	0	0	0.8	0	1	0
	Notional	352.5	0	113.6	0	0	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	104.5	128.1	8.9	12.5	6.7	3.26	2.84	3.5	4
	Notional	150.8	73.6	16.4	5.4	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	129.7	0	45	0	34.1	0.8	0	1	0
	Notional	309.8	0	99.8	0	38.9	0.86	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.21	10000002:Surf[1]
Floor	0.2	0.2	10000002:Surf[0]
Roof	0.15	0.18	10000008:Surf[3]
Windows, roof windows, and rooflights	1.5	0.8	10000008:Surf[0]
Personnel doors	1.5	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	10000008:Surf[19]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.57

Appendix C. BRUKL Output Document – Unit A-2010

Project name

Shell and Core

Unit A - S2 As Built - 2010 Regulations

As designed

Date: Fri Nov 20 15:41:45 2015

Administrative information**Building Details**

Address: Unit A, HAYES , UB3 1DQ

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.5
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.5
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	9.4
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency**2.a Building fabric**

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.21	0.21	10000002:Surf[1]
Floor	0.25	0.2	0.2	10000002:Surf[0]
Roof	0.25	0.18	0.18	10000008:Surf[3]
Windows***, roof windows, and rooflights	2.2	1.19	1.5	10000008:Surf[16]
Personnel doors	2.2	1.4	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	1.5	10000008:Surf[19]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.57

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03 - Office - VRF Mech Vent HR-60%

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.5	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U10003WC	-	-	0.5
U10101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U10002Stairs	YES
U10003WC	YES
U10001Warehouse	YES
U10101OfficeMezzanine	YES
U10102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U10002Stairs	70	-
U10003WC	90	-
U10001Warehouse	3170	-
U10101OfficeMezzanine	1170	-
U10102Stairs	60	-

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?
U10001Warehouse	NO (-43.5%)	NO
U10101OfficeMezzanine	NO (-57.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	666.5	666.5
External area [m ²]	1948.8	1948.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	504.55	671.49
Average U-value [W/m ² K]	0.26	0.34
Alpha value* [%]	10	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	25.24	49.64
Cooling	2.4	1.02
Auxiliary	1.74	1.16
Lighting	19.03	18.9
Hot water	4.32	4.58
Equipment*	32.35	32.35
TOTAL **	52.72	75.3

* Energy used by equipment does not count towards the total for 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	22.43	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	113.92	188.27
Primary energy* [kWh/m ²]	118.15	124.21
Total emissions [kg/m ²]	9.4	23.5

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	71.7	0	25.3	0	0	0.79	0	0.91	0
	Notional	164.2	0	53.5	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	280	0	97.2	0	0	0.8	0	1	0
	Notional	374.7	0	124.8	0	0	0.83	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	113.9	120.3	9.7	11.8	6.7	3.26	2.84	3.5	4
	Notional	164.7	68.6	17.9	5	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	147	0	51.1	0	34.1	0.8	0	1	0
	Notional	310.4	0	103.4	0	38.9	0.83	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.21	10000002:Surf[1]
Floor	0.2	0.2	10000002:Surf[0]
Roof	0.15	0.18	10000008:Surf[3]
Windows, roof windows, and rooflights	1.5	0.8	10000008:Surf[0]
Personnel doors	1.5	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	10000008:Surf[19]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.57

Appendix D. BRUKL Output Document – Unit A-2010 – No Renewables

Project name

Shell and Core

Unit A - S2 As Built - 2010 Regulations - no renewables

As designed

Date: Fri Nov 20 15:45:03 2015

Administrative information**Building Details**

Address: Unit A, HAYES , UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.9
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.9
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	21.8
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency**2.a Building fabric**

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.21	0.21	10000002:Surf[1]
Floor	0.25	0.2	0.2	10000002:Surf[0]
Roof	0.25	0.18	0.18	10000008:Surf[3]
Windows***, roof windows, and rooflights	2.2	1.19	1.5	10000008:Surf[16]
Personnel doors	2.2	1.4	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	1.5	10000008:Surf[19]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.57

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03R - Office - Nat gas heating VRF Mech Vent HR-60% - Renewables replacement

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.86	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U10003WC	-	-	0.5
U10101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U10002Stairs	YES
U10003WC	YES
U10001Warehouse	YES
U10101OfficeMezzanine	YES
U10102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U10002Stairs	70	-
U10003WC	90	-
U10001Warehouse	3170	-
U10101OfficeMezzanine	1170	-
U10102Stairs	60	-

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?
U10001Warehouse	NO (-43.5%)	NO
U10101OfficeMezzanine	NO (-57.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	666.5	666.5
External area [m ²]	1948.8	1948.8
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	504.55	671.49
Average U-value [W/m ² K]	0.26	0.34
Alpha value* [%]	10	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	31.3	57.17
Cooling	2.4	1.02
Auxiliary	1.74	1.16
Lighting	19.03	18.9
Hot water	4.32	4.58
Equipment*	32.35	32.35
TOTAL **	58.78	82.83

* Energy used by equipment does not count towards the total for 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	Indicative Target
Heating + cooling demand [MJ/m ²]	113.92	188.27
Primary energy* [kWh/m ²]	120.58	124.97
Total emissions [kg/m ²]	21.8	23.9

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	71.7	0	25.3	0	0	0.79	0	0.91	0
	Notional	164.2	0	53.5	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	280	0	97.2	0	0	0.8	0	1	0
	Notional	374.7	0	124.8	0	0	0.83	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	147	0	51.1	0	34.1	0.8	0	1	0
	Notional	310.4	0	103.4	0	38.9	0.83	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	113.9	120.3	39.5	11.8	6.7	0.8	2.84	0.86	4
	Notional	164.7	68.6	54.9	5	3.6	0.83	3.79	----	----

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.21	10000002:Surf[1]
Floor	0.2	0.2	10000002:Surf[0]
Roof	0.15	0.18	10000008:Surf[3]
Windows, roof windows, and rooflights	1.5	0.8	10000008:Surf[0]
Personnel doors	1.5	1.4	10000008:Surf[8]
Vehicle access & similar large doors	1.5	1.5	10000008:Surf[19]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.57

Appendix E. BRUKL Output Document – Unit B – 2013

Project name

Shell and Core

Unit B - S2 As Built - 2013 Regulations

As designed

Date: Fri Nov 20 15:53:23 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	8.6
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.21	20000002:Surf[1]
Floor	0.25	0.16	0.16	20000002:Surf[0]
Roof	0.25	0.18	0.18	20000000:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.04	1.5	20000000:Surf[23]
Personnel doors	2.2	1.4	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	1.5	20000000:Surf[31]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.16	0	-
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

2- 02 - WC / Circulation - Electric extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.1	0	-
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

3- 01 - Warehouse - Flued forced convection Nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
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

4- 03 - Office - VRF Mech Vent HR-60%

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	0	0.6
Standard value	2.5*	3.2	N/A	N/A	0.5
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.					

1- 04 - DHW electric instant

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
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			
U20101OfficeMezzanine	-	-	-	1.6	-	-	-	-	-		-	N/A

Shell and core configuration

Zone	Assumed shell?
U20002Stairs	YES
U20003WC	YES
U20001Warehouse	YES
U20101OfficeMezzanine	YES
U20102Stairs	YES

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
U20002Stairs		-	60	-	84
U20003WC		-	60	-	111
U20001Warehouse		60	-	-	13363
U20101OfficeMezzanine		60	-	-	2368
U20102Stairs		-	60	-	142

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?
U20001Warehouse	NO (-43.5%)	NO
U20101OfficeMezzanine	NO (-35.3%)	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]	2078.3	2078.3
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	7
Average conductance [W/K]	3969.63	5030.05
Average U-value [W/m ² K]	0.26	0.32
Alpha value* [%]	9.29	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	16.37	43.74
Cooling	1.72	0.47
Auxiliary	1.61	0.53
Lighting	19.72	17.89
Hot water	4.39	4.58
Equipment*	31.22	31.22
TOTAL **	43.81	67.21

* Energy used by equipment does not count towards the total for 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	19.14	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]	71.77	151.13
Primary energy* [kWh/m ²]	111.46	121.67
Total emissions [kg/m ²]	8.6	21.2

* 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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	45.6	0	16.1	0	0	0.79	0	0.91	0
	Notional	142.9	0	46	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	190.3	0	66.1	0	0	0.8	0	1	0
	Notional	287.9	0	92.8	0	0	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	91.9	159.6	7.8	15.6	6.7	3.26	2.84	3.5	4
	Notional	123.6	57.8	13.4	4.2	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	132.9	0	46.2	0	34.1	0.8	0	1	0
	Notional	363.8	0	117.2	0	38.9	0.86	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.16	20000000:Surf[46]
Floor	0.2	0.16	20000002:Surf[0]
Roof	0.15	0.18	20000000:Surf[6]
Windows, roof windows, and rooflights	1.5	0.8	20000000:Surf[0]
Personnel doors	1.5	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	20000000:Surf[31]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix F. BRUKL Output Document – Unit B-2010

Project name

Shell and Core

Unit B - S2 As Built - 2010 Regulations

As designed

Date: Fri Nov 20 15:59:18 2015

Administrative information

Building Details

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJCriterion 1: The calculated CO₂ emission rate for the building should not exceed the target

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.8
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.8
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	6.6
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

2.a Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.21	20000002:Surf[1]
Floor	0.25	0.16	0.16	20000002:Surf[0]
Roof	0.25	0.18	0.18	20000000:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.04	1.5	20000000:Surf[23]
Personnel doors	2.2	1.4	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	1.5	20000000:Surf[31]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03 - Office - VRF Mech Vent HR-60%

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.5	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U20003WC	-	-	0.5
U20101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U20002Stairs	YES
U20003WC	YES
U20001Warehouse	YES
U20101OfficeMezzanine	YES
U20102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U20002Stairs	70	-
U20003WC	90	-
U20001Warehouse	10720	-
U20101OfficeMezzanine	1900	-
U20102Stairs	110	-

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?
U20001Warehouse	NO (-43.5%)	NO
U20101OfficeMezzanine	NO (-35.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	2078.3	2078.3
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	5076.31
Average U-value [W/m ² K]	0.26	0.33
Alpha value* [%]	9.29	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	18.66	47.54
Cooling	1.63	0.43
Auxiliary	1.61	0.53
Lighting	15.99	15.35
Hot water	4.39	4.65
Equipment*	31.22	31.22
TOTAL **	42.27	68.49

* Energy used by equipment does not count towards the total for 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	19.14	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	78.05	161.43
Primary energy* [kWh/m ²]	93.03	104.18
Total emissions [kg/m ²]	6.6	19.8

* 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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	52.6	0	18.5	0	0	0.79	0	0.91	0
	Notional	153.6	0	50.1	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	197.4	0	68.5	0	0	0.8	0	1	0
	Notional	302.2	0	100.7	0	0	0.83	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	100.4	151.3	8.5	14.8	6.7	3.26	2.84	3.5	4
	Notional	134.4	53.2	14.6	3.9	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	150.7	0	52.3	0	34.1	0.8	0	1	0
	Notional	363	0	120.9	0	38.9	0.83	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.16	20000000:Surf[46]
Floor	0.2	0.16	20000002:Surf[0]
Roof	0.15	0.18	20000000:Surf[6]
Windows, roof windows, and rooflights	1.5	0.8	20000000:Surf[0]
Personnel doors	1.5	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	20000000:Surf[31]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix G. BRUKL Output Document – Unit B-2010 – No Renewables

Project name

Shell and Core

Unit B - S2 As Built - 2010 Regulations - no renewables

As designed

Date: Fri Nov 20 16:06:53 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.9
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.9
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency**2.a Building fabric**

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.21	20000002:Surf[1]
Floor	0.25	0.16	0.16	20000002:Surf[0]
Roof	0.25	0.18	0.18	20000000:Surf[6]
Windows***, roof windows, and rooflights	2.2	1.04	1.5	20000000:Surf[23]
Personnel doors	2.2	1.4	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	1.5	20000000:Surf[31]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03R - Office - Nat gas heating VRF Mech Vent HR-60% - Renewables replacement

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.86	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U20003WC	-	-	0.5
U20101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U20002Stairs	YES
U20003WC	YES
U20001Warehouse	YES
U20101OfficeMezzanine	YES
U20102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U20002Stairs	70	-
U20003WC	90	-
U20001Warehouse	10720	-
U20101OfficeMezzanine	1900	-
U20102Stairs	110	-

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?
U20001Warehouse	NO (-43.5%)	NO
U20101OfficeMezzanine	NO (-35.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	2078.3	2078.3
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	5076.31
Average U-value [W/m ² K]	0.26	0.33
Alpha value* [%]	9.29	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	21.55	50.85
Cooling	1.63	0.43
Auxiliary	1.61	0.53
Lighting	15.99	15.35
Hot water	4.39	4.65
Equipment*	31.22	31.22
TOTAL **	45.16	71.81

* Energy used by equipment does not count towards the total for 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	Indicative Target
Heating + cooling demand [MJ/m ²]	78.05	161.43
Primary energy* [kWh/m ²]	94.19	104.51
Total emissions [kg/m ²]	17	19.9

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	52.6	0	18.5	0	0	0.79	0	0.91	0
	Notional	153.6	0	50.1	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	197.4	0	68.5	0	0	0.8	0	1	0
	Notional	302.2	0	100.7	0	0	0.83	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	150.7	0	52.3	0	34.1	0.8	0	1	0
	Notional	363	0	120.9	0	38.9	0.83	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	100.4	151.3	34.8	14.8	6.7	0.8	2.84	0.86	4
	Notional	134.4	53.2	44.8	3.9	3.6	0.83	3.79	----	----

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.16	20000000:Surf[46]
Floor	0.2	0.16	20000002:Surf[0]
Roof	0.15	0.18	20000000:Surf[6]
Windows, roof windows, and rooflights	1.5	0.8	20000000:Surf[0]
Personnel doors	1.5	1.4	20000000:Surf[14]
Vehicle access & similar large doors	1.5	1.5	20000000:Surf[31]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix H. BRUKL Output Document – Unit C – 2013

Project name

Shell and Core

Unit C - S2 As Built - 2013 Regulations

As designed

Date: Fri Nov 20 16:13:04 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	22.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	22.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	12.8
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.28	30000002:Surf[6]
Floor	0.25	0.16	0.16	30000002:Surf[0]
Roof	0.25	0.18	0.18	30000007:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.03	1.5	30000007:Surf[1]
Personnel doors	2.2	1.4	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	1.5	30000005:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
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

2- 02 - WC / Circulation - Electric extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.1	0	-
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

3- 03 - Office - VRF Mech Vent HR-60%

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	0	0.6
Standard value	2.5*	3.2	N/A	N/A	0.5
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.

4- 01 - Warehouse - Flued forced convection Nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
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- 04 - DHW electric instant

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
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			
U30101OfficeMezzanine	-	-	-	1.6	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
U30002Stairs	YES
U30003WC	YES
U30101OfficeMezzanine	YES
U30102Stairs	YES
U30001Warehouse	YES

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
U30002Stairs		-	60	-	85
U30003WC		-	60	-	115
U30101OfficeMezzanine		60	-	-	1386
U30102Stairs		-	60	-	57
U30001Warehouse		60	-	-	6766

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?
U30101OfficeMezzanine	NO (-33.1%)	NO
U30001Warehouse	NO (-25.3%)	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]	1050.2	1050.2
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	7
Average conductance [W/K]	3969.63	4831.08
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.95	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	18.07	45.83
Cooling	2.21	0.49
Auxiliary	2.56	0.73
Lighting	19.44	19.43
Hot water	4.36	4.55
Equipment*	31.36	31.36
TOTAL **	46.65	71.05

* Energy used by equipment does not count towards the total for 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	13.44	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]	82.3	159.06
Primary energy* [kWh/m ²]	118.98	130.27
Total emissions [kg/m ²]	12.8	22.6

* 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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	49.5	0	17.4	0	0	0.79	0	0.91	0
	Notional	151.4	0	48.8	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	241.2	0	83.7	0	0	0.8	0	1	0
	Notional	301.6	0	97.2	0	0	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	86.4	179.5	7.4	17.6	6.7	3.26	2.84	3.5	4
	Notional	120.9	53.3	13.1	3.9	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	117.8	0	40.9	0	34.1	0.8	0	1	0
	Notional	268.5	0	86.5	0	38.9	0.86	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 SSEEF	= 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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	30000005:Surf[33]
Floor	0.2	0.16	30000002:Surf[0]
Roof	0.15	0.18	30000007:Surf[0]
Windows, roof windows, and rooflights	1.5	0.8	30000005:Surf[0]
Personnel doors	1.5	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	30000005:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix I. BRUKL Output Document – Unit C-2010

Project name

Shell and Core

Unit C - S2 As Built - 2010 Regulations

As designed

Date: Fri Nov 20 16:15:56 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.1
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.1
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	10.9
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency**2.a Building fabric**

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.28	30000002:Surf[6]
Floor	0.25	0.16	0.16	30000002:Surf[0]
Roof	0.25	0.18	0.18	30000007:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.03	1.5	30000007:Surf[1]
Personnel doors	2.2	1.4	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	1.5	30000005:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 03 - Office - VRF Mech Vent HR-60%

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.5	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U30003WC	-	-	0.5
U30101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U30002Stairs	YES
U30003WC	YES
U30101OfficeMezzanine	YES
U30102Stairs	YES
U30001Warehouse	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U30002Stairs	70	-
U30003WC	90	-
U30101OfficeMezzanine	1110	-
U30102Stairs	50	-
U30001Warehouse	5430	-

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?
U30101OfficeMezzanine	NO (-33.1%)	NO
U30001Warehouse	NO (-25.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	1050.2	1050.2
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	4866.22
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.95	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	20.29	49.73
Cooling	2.11	0.45
Auxiliary	2.56	0.73
Lighting	15.76	16.66
Hot water	4.36	4.62
Equipment*	31.36	31.36
TOTAL **	45.08	72.19

* Energy used by equipment does not count towards the total for 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	13.44	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	88.3	169.57
Primary energy* [kWh/m ²]	99.96	111.28
Total emissions [kg/m ²]	10.9	21.1

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.4	0	19.9	0	0	0.79	0	0.91	0
	Notional	162.7	0	53	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	246.6	0	85.6	0	0	0.8	0	1	0
	Notional	309.4	0	103.1	0	0	0.83	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	94.5	171	8	16.7	6.7	3.26	2.84	3.5	4
	Notional	131.1	48.8	14.2	3.6	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	133.9	0	46.5	0	34.1	0.8	0	1	0
	Notional	276.8	0	92.2	0	38.9	0.83	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	30000005:Surf[33]
Floor	0.2	0.16	30000002:Surf[0]
Roof	0.15	0.18	30000007:Surf[0]
Windows, roof windows, and rooflights	1.5	0.8	30000005:Surf[0]
Personnel doors	1.5	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	30000005:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix J. BRUKL Output Document – Unit C- 2010 – No Renewables

Project name

Shell and Core

Unit C - S2 As Built - 2010 Regulations - No Renewables

As designed

Date: Fri Nov 20 16:18:33 2015

Administrative information

Building Details

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.3
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.3
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	18.3
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

2.a Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.28	30000002:Surf[6]
Floor	0.25	0.16	0.16	30000002:Surf[0]
Roof	0.25	0.18	0.18	30000007:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.03	1.5	30000007:Surf[1]
Personnel doors	2.2	1.4	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	1.5	30000005:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 03R - Office - Nat gas heating VRF Mech Vent HR-60% - Renewables replacement

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.86	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U30003WC	-	-	0.5
U30101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U30002Stairs	YES
U30003WC	YES
U30101OfficeMezzanine	YES
U30102Stairs	YES
U30001Warehouse	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U30002Stairs	70	-
U30003WC	90	-
U30101OfficeMezzanine	1110	-
U30102Stairs	50	-
U30001Warehouse	5430	-

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?
U30101OfficeMezzanine	NO (-33.1%)	NO
U30001Warehouse	NO (-25.3%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	1050.2	1050.2
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	4866.22
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.95	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	23.4	53.44
Cooling	2.11	0.45
Auxiliary	2.56	0.73
Lighting	15.76	16.66
Hot water	4.36	4.62
Equipment*	31.36	31.36
TOTAL **	48.2	75.91

* Energy used by equipment does not count towards the total for 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	Indicative Target
Heating + cooling demand [MJ/m ²]	88.3	169.57
Primary energy* [kWh/m ²]	101.21	111.65
Total emissions [kg/m ²]	18.3	21.3

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.4	0	19.9	0	0	0.79	0	0.91	0
	Notional	162.7	0	53	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	246.6	0	85.6	0	0	0.8	0	1	0
	Notional	309.4	0	103.1	0	0	0.83	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	133.9	0	46.5	0	34.1	0.8	0	1	0
	Notional	276.8	0	92.2	0	38.9	0.83	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	94.5	171	32.8	16.7	6.7	0.8	2.84	0.86	4
	Notional	131.1	48.8	43.7	3.6	3.6	0.83	3.79	----	----

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	30000005:Surf[33]
Floor	0.2	0.16	30000002:Surf[0]
Roof	0.15	0.18	30000007:Surf[0]
Windows, roof windows, and rooflights	1.5	0.8	30000005:Surf[0]
Personnel doors	1.5	1.4	30000005:Surf[16]
Vehicle access & similar large doors	1.5	1.5	30000005:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix K. BRUKL Output Document – Unit D – 2013

Project name

Shell and Core

Unit D - S2 As Built - 2013 Regulations

As designed

Date: Fri Nov 20 16:25:51 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	22.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	22.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	14.9
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.21	40000002:Surf[3]
Floor	0.25	0.16	0.16	40000002:Surf[0]
Roof	0.25	0.18	0.18	40000007:Surf[7]
Windows***, roof windows, and rooflights	2.2	1	1.5	40000007:Surf[22]
Personnel doors	2.2	1.4	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	1.5	40000007:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.15	0	-
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

2- 02 - WC / Circulation - Electric extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.1	0	-
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

3- 01 - Warehouse - Flued forced convection Nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
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

4- 03 - Office - VRF Mech Vent HR-60%

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	0	0.6
Standard value	2.5*	3.2	N/A	N/A	0.5
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.					

1- 04 - DHW electric instant

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
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			
U40101OfficeMezzanine	-	-	-	1.6	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
U40002Stairs	YES
U40003WC	YES
U40001Warehouse	YES
U40101OfficeMezzanine	YES
U40102Stairs	YES

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
U40002Stairs		-	60	-	94
U40003WC		-	60	-	118
U40001Warehouse		60	-	-	7066
U40101OfficeMezzanine		60	-	-	1340
U40102Stairs		-	60	-	58

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?
U40001Warehouse	NO (-23%)	NO
U40101OfficeMezzanine	NO (-41.5%)	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]	1087.1	1087.1
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	7
Average conductance [W/K]	3969.63	4833.01
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.93	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	18.77	47.04
Cooling	2.04	0.44
Auxiliary	2.44	0.7
Lighting	18.94	19.3
Hot water	4.36	4.55
Equipment*	31.2	31.2
TOTAL **	46.54	72.04

* Energy used by equipment does not count towards the total for 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	8.76	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]	81.84	161.59
Primary energy* [kWh/m ²]	116.82	130.64
Total emissions [kg/m ²]	14.9	22.8

* 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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	51.9	0	18.3	0	0	0.79	0	0.91	0
	Notional	154	0	49.6	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	227.1	0	78.8	0	0	0.8	0	1	0
	Notional	315.3	0	101.6	0	0	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	85.5	177.1	7.3	17.3	6.7	3.26	2.84	3.5	4
	Notional	122.2	51.4	13.3	3.8	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	98.8	0	34.3	0	34.1	0.8	0	1	0
	Notional	269.5	0	86.8	0	38.9	0.86	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	40000007:Surf[28]
Floor	0.2	0.16	40000002:Surf[0]
Roof	0.15	0.18	40000007:Surf[7]
Windows, roof windows, and rooflights	1.5	0.8	40000007:Surf[0]
Personnel doors	1.5	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	40000007:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix L. BRUKL Output Document – Unit D-2010

Project name

Shell and Core

Unit D - S2 As Built - 2010 Regulations

As designed

Date: Fri Nov 20 16:31:36 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.2
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.2
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.1
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency**2.a Building fabric**

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.21	40000002:Surf[3]
Floor	0.25	0.16	0.16	40000002:Surf[0]
Roof	0.25	0.18	0.18	40000007:Surf[7]
Windows***, roof windows, and rooflights	2.2	1	1.5	40000007:Surf[22]
Personnel doors	2.2	1.4	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	1.5	40000007:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03 - Office - VRF Mech Vent HR-60%

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.5	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U40003WC	-	-	0.5
U40101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U40002Stairs	YES
U40003WC	YES
U40001Warehouse	YES
U40101OfficeMezzanine	YES
U40102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U40002Stairs	80	-
U40003WC	100	-
U40001Warehouse	5670	-
U40101OfficeMezzanine	1080	-
U40102Stairs	50	-

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?
U40001Warehouse	NO (-23%)	NO
U40101OfficeMezzanine	NO (-41.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	1087.1	1087.1
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	4867.19
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.93	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	20.98	50.97
Cooling	1.94	0.41
Auxiliary	2.44	0.7
Lighting	15.37	16.55
Hot water	4.36	4.61
Equipment*	31.2	31.2
TOTAL **	45.08	73.25

* Energy used by equipment does not count towards the total for 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	8.76	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m ²]	87.85	172.15
Primary energy* [kWh/m ²]	98.29	111.82
Total emissions [kg/m ²]	13.1	21.2

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	58.8	0	20.7	0	0	0.79	0	0.91	0
	Notional	165.3	0	53.9	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	232.7	0	80.8	0	0	0.8	0	1	0
	Notional	323.6	0	107.8	0	0	0.83	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	93.5	168.7	8	16.5	6.7	3.26	2.84	3.5	4
	Notional	132.5	47.1	14.4	3.5	3.6	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	114.2	0	39.6	0	34.1	0.8	0	1	0
	Notional	277.6	0	92.5	0	38.9	0.83	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	40000007:Surf[28]
Floor	0.2	0.16	40000002:Surf[0]
Roof	0.15	0.18	40000007:Surf[7]
Windows, roof windows, and rooflights	1.5	0.8	40000007:Surf[0]
Personnel doors	1.5	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	40000007:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix M. BRUKL Output Document – Unit D-2010 – No Renewables

Project name

Shell and Core

Unit D - S2 As Built - 2010 Regulations - No Renewables

As designed

Date: Fri Nov 20 16:33:45 2015

Administrative information

Building Details

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.4
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.4
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	18
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

2.a Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.21	40000002:Surf[3]
Floor	0.25	0.16	0.16	40000002:Surf[0]
Roof	0.25	0.18	0.18	40000007:Surf[7]
Windows***, roof windows, and rooflights	2.2	1	1.5	40000007:Surf[22]
Personnel doors	2.2	1.4	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	1.5	40000007:Surf[26]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 02 - WC / Circulation - Electric

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

2- 02 - WC / Circulation - Electric extract

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
1	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

3- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

4- 03R - Office - Nat gas heating VRF Mech Vent HR-60% - Renewables replacement

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.86	3.5	0	0.6
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
U40003WC	-	-	0.5
U40101OfficeMezzanine	1.6	-	-

Shell and core configuration

Zone	Assumed shell?
U40002Stairs	YES
U40003WC	YES
U40001Warehouse	YES
U40101OfficeMezzanine	YES
U40102Stairs	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U40002Stairs	80	-
U40003WC	100	-
U40001Warehouse	5670	-
U40101OfficeMezzanine	1080	-
U40102Stairs	50	-

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?
U40001Warehouse	NO (-23%)	NO
U40101OfficeMezzanine	NO (-41.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	1087.1	1087.1
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	4867.19
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	9.93	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	23.85	54.48
Cooling	1.94	0.41
Auxiliary	2.44	0.7
Lighting	15.37	16.55
Hot water	4.36	4.61
Equipment*	31.2	31.2
TOTAL **	47.96	76.75

* Energy used by equipment does not count towards the total for 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	Indicative Target
Heating + cooling demand [MJ/m ²]	87.85	172.15
Primary energy* [kWh/m ²]	99.44	112.17
Total emissions [kg/m ²]	18	21.4

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	58.8	0	20.7	0	0	0.79	0	0.91	0
	Notional	165.3	0	53.9	0	0	0.85	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	232.7	0	80.8	0	0	0.8	0	1	0
	Notional	323.6	0	107.8	0	0	0.83	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	114.2	0	39.6	0	34.1	0.8	0	1	0
	Notional	277.6	0	92.5	0	38.9	0.83	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	93.5	168.7	32.4	16.5	6.7	0.8	2.84	0.86	4
	Notional	132.5	47.1	44.2	3.5	3.6	0.83	3.79	----	----

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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.19	40000007:Surf[28]
Floor	0.2	0.16	40000002:Surf[0]
Roof	0.15	0.18	40000007:Surf[7]
Windows, roof windows, and rooflights	1.5	0.8	40000007:Surf[0]
Personnel doors	1.5	1.4	40000007:Surf[17]
Vehicle access & similar large doors	1.5	1.5	40000007:Surf[26]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix N. BRUKL Output Document – Unit E – 2013

Project name

Shell and Core

Unit E - S2 As Built - 2013 Regulations

As designed

Date: Fri Nov 20 16:39:18 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	25.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	25.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	21.2
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.2	0.21	50000000:Surf[0]
Floor	0.25	0.16	0.16	50000000:Surf[16]
Roof	0.25	0.18	0.18	50000000:Surf[58]
Windows***, roof windows, and rooflights	2.2	0.98	1.5	50000000:Surf[3]
Personnel doors	2.2	1.4	1.4	50000000:Surf[12]
Vehicle access & similar large doors	1.5	5.88	5.88	50000000:Surf[10]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 01 - Warehouse - Flued forced convection Nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
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- 04 - DHW electric instant

	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"

Shell and core configuration

Zone	Assumed shell?
U50001Warehouse	YES

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
U50001Warehouse		60	-	-	10595

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?
U50001Warehouse	NO (-20.1%)	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]	1374.3	1374.3
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	7
Average conductance [W/K]	3969.63	4820.1
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	10.85	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	39.16	67.75
Cooling	0	0
Auxiliary	1.5	0
Lighting	18.55	18
Hot water	4.46	4.66
Equipment*	29.87	29.87
TOTAL **	63.67	90.41

* Energy used by equipment does not count towards the total for 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]	111.19	210.28
Primary energy* [kWh/m ²]	123.03	141.67
Total emissions [kg/m ²]	21.2	25.2

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity									
Actual	111.2	0	39.2	0	0	0.79	0	0.91	0
Notional	210.3	0	67.8	0	0	0.86	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	50000000:Surf[68]
Floor	0.2	0.16	50000000:Surf[16]
Roof	0.15	0.18	50000000:Surf[58]
Windows, roof windows, and rooflights	1.5	0.8	50000000:Surf[50]
Personnel doors	1.5	1.4	50000000:Surf[12]
Vehicle access & similar large doors	1.5	5.88	50000000:Surf[10]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix O. BRUKL Output Document – Unit E-2010

Project name

Shell and Core

Unit E - S2 As Built - 2010 Regulations

As designed

Date: Fri Nov 20 16:43:03 2015

Administrative information**Building Details**

Address: HAYES, UB3 1DQ

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

Certifier details

Name: Richard de Fleury

Telephone number: 0845 621 22 22

Address: 6 Silkwood Business Park, Fryer's Way,
Wakefield, WF5 9TJ**Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target**

1.1	CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	23.4
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	23.4
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.2
1.4	Are emissions from the building less than or equal to the target?	BER ≤ TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

The building does not follow guidance in England and Wales Building Regulations Part L 2010

2.a Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.21	50000000:Surf[0]
Floor	0.25	0.16	0.16	50000000:Surf[16]
Roof	0.25	0.18	0.18	50000000:Surf[58]
Windows***, roof windows, and rooflights	2.2	0.98	1.5	50000000:Surf[3]
Personnel doors	2.2	1.4	1.4	50000000:Surf[12]
Vehicle access & similar large doors	1.5	5.88	5.88	50000000:Surf[10]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	2.27

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 01 - Warehouse - Flued forced convection Nat vent

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
0.91	-	0	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- 04 - DHW electric instant

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

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

Shell and core configuration

Zone	Assumed shell?
U50001Warehouse	YES

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
U50001Warehouse	8500	-

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?
U50001Warehouse	NO (-20.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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]	1374.3	1374.3
External area [m ²]	15482.1	15482.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	2	5
Average conductance [W/K]	3969.63	4820.08
Average U-value [W/m ² K]	0.26	0.31
Alpha value* [%]	10.85	10

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	42.05	72.57
Cooling	0	0
Auxiliary	1.5	0
Lighting	15.05	15.17
Hot water	4.46	4.71
Equipment*	29.87	29.87
TOTAL **	63.07	92.45

* Energy used by equipment does not count towards the total for 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	Indicative Target
Heating + cooling demand [MJ/m ²]	119.41	222.75
Primary energy* [kWh/m ²]	104.25	123.3
Total emissions [kg/m ²]	19.2	23.4

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	119.4	0	42.1	0	0	0.79	0	0.91	0
	Notional	222.8	0	72.6	0	0	0.85	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	50000000:Surf[68]
Floor	0.2	0.16	50000000:Surf[16]
Roof	0.15	0.18	50000000:Surf[58]
Windows, roof windows, and rooflights	1.5	0.8	50000000:Surf[50]
Personnel doors	1.5	1.4	50000000:Surf[12]
Vehicle access & similar large doors	1.5	5.88	50000000:Surf[10]
High usage entrance doors	1.5	-	No High usage entrance doors in building
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	2.27

Appendix P. Preliminary EPC – Unit A

The following EPC is based upon information outlined within this report. A final EPC cannot be generated until the as-built and as-installed information relating to the constructed development or, first fit-out is available.

Energy Performance Certificate

Non-Domestic Building



Unit A

Crosspoint Distribution Park

Swallowfield Way

HAYES

UB3 1DQ

Certificate Reference Number:

0000-0035-0009-0029-0092

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 on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

13

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	666.455
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ²):	11.79

Benchmarks

Buildings similar to this one could have ratings as follows:

27 If newly built

73 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software: Virtual Environment v7.0.4 using calculation engine ApacheSim v7.0.4

Property Reference: 000000000000

Assessor Name: Richard de Fleury

Assessor Number: STRO006005

Accreditation Scheme: Stroma Accreditation Ltd

Employer/Trading Name: STROMA Technology Ltd

Employer/Trading Address: Unit 6, Silkwood Business Park, Fryers Way, WEST YORKSHIRE, WF5 9TJ

Issue Date: 20 Nov 2015

Valid Until: 19 Nov 2025 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0090-2090-0040-0090-0503

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.



For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on **0800 085 2005**

Appendix Q. Preliminary EPC – Unit B

The following EPC is based upon information outlined within this report. A final EPC cannot be generated until the as-built and as-installed information relating to the constructed development or, first fit-out is available.

Energy Performance Certificate

Non-Domestic Building



Unit B

Crosspoint Distribution Park

Swallowfield Way

HAYES

UB3 1DQ

Certificate Reference Number:

0000-0035-0009-0029-0092

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 on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

10

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	2078.286
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ²):	8.6

Benchmarks

Buildings similar to this one could have ratings as follows:

24 If newly built

64 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software: Virtual Environment v7.0.4 using calculation engine ApacheSim v7.0.4

Property Reference: 000000000000

Assessor Name: Richard de Fleury

Assessor Number: STRO006005

Accreditation Scheme: Stroma Accreditation Ltd

Employer/Trading Name: STROMA Technology Ltd

Employer/Trading Address: Unit 6, Silkwood Business Park, Fryers Way, WEST YORKSHIRE, WF5 9TJ

Issue Date: 20 Nov 2015

Valid Until: 19 Nov 2025 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0090-2090-0040-0090-0503

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.



For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on 0800 085 2005

Appendix R. Preliminary EPC – Unit C

The following EPC is based upon information outlined within this report. A final EPC cannot be generated until the as-built and as-installed information relating to the constructed development or, first fit-out is available.

Energy Performance Certificate

Non-Domestic Building



Unit C

Crosspoint Distribution Park

Swallowfield Way

HAYES

UB3 1DQ

Certificate Reference Number:

0000-0035-0009-0029-0092

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 on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

15

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	1050.240
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ²):	12.8

Benchmarks

Buildings similar to this one could have ratings as follows:

26 If newly built

69 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software: Virtual Environment v7.0.4 using calculation engine ApacheSim v7.0.4

Property Reference: 000000000000

Assessor Name: Richard de Fleury

Assessor Number: STRO006005

Accreditation Scheme: Stroma Accreditation Ltd

Employer/Trading Name: STROMA Technology Ltd

Employer/Trading Address: Unit 6, Silkwood Business Park, Fryers Way, WEST YORKSHIRE, WF5 9TJ

Issue Date: 20 Nov 2015

Valid Until: 19 Nov 2025 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0090-2090-0040-0090-0503

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.



For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on **0800 085 2005**

Appendix S. Preliminary EPC – Unit D

The following EPC is based upon information outlined within this report. A final EPC cannot be generated until the as-built and as-installed information relating to the constructed development or, first fit-out is available.

Energy Performance Certificate

Non-Domestic Building



Unit D

Crosspoint Distribution Park

Swallowfield Way

HAYES

UB3 1DQ

Certificate Reference Number:

0000-0035-0009-0029-0092

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 on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

17

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	1087.110
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ²):	14.91

Benchmarks

Buildings similar to this one could have ratings as follows:

26 If newly built

69 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software: Virtual Environment v7.0.4 using calculation engine ApacheSim v7.0.4

Property Reference: 000000000000

Assessor Name: Richard de Fleury

Assessor Number: STRO006005

Accreditation Scheme: Stroma Accreditation Ltd

Employer/Trading Name: STROMA Technology Ltd

Employer/Trading Address: Unit 6, Silkwood Business Park, Fryers Way, WEST YORKSHIRE, WF5 9TJ

Issue Date: 20 Nov 2015

Valid Until: 19 Nov 2025 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0090-2090-0040-0090-0503

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.



For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on **0800 085 2005**

Appendix T. Preliminary EPC – Unit E

The following EPC is based upon information outlined within this report. A final EPC cannot be generated until the as-built and as-installed information relating to the constructed development or, first fit-out is available.

Energy Performance Certificate

Non-Domestic Building



Unit E

Crosspoint Distribution Park

Swallowfield Way

HAYES

UB3 1DQ

Certificate Reference Number:

0000-0035-0009-0029-0092

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 on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

21

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	1374.304
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ²):	21.18

Benchmarks

Buildings similar to this one could have ratings as follows:

25 If newly built

66 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software: Virtual Environment v7.0.4 using calculation engine ApacheSim v7.0.4

Property Reference: 000000000000

Assessor Name: Richard de Fleury

Assessor Number: STRO006005

Accreditation Scheme: Stroma Accreditation Ltd

Employer/Trading Name: STROMA Technology Ltd

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Issue Date: 20 Nov 2015

Valid Until: 19 Nov 2025 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0090-2090-0040-0090-0503

If you have a complaint or wish to confirm that the certificate is genuine

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For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on 0800 085 2005