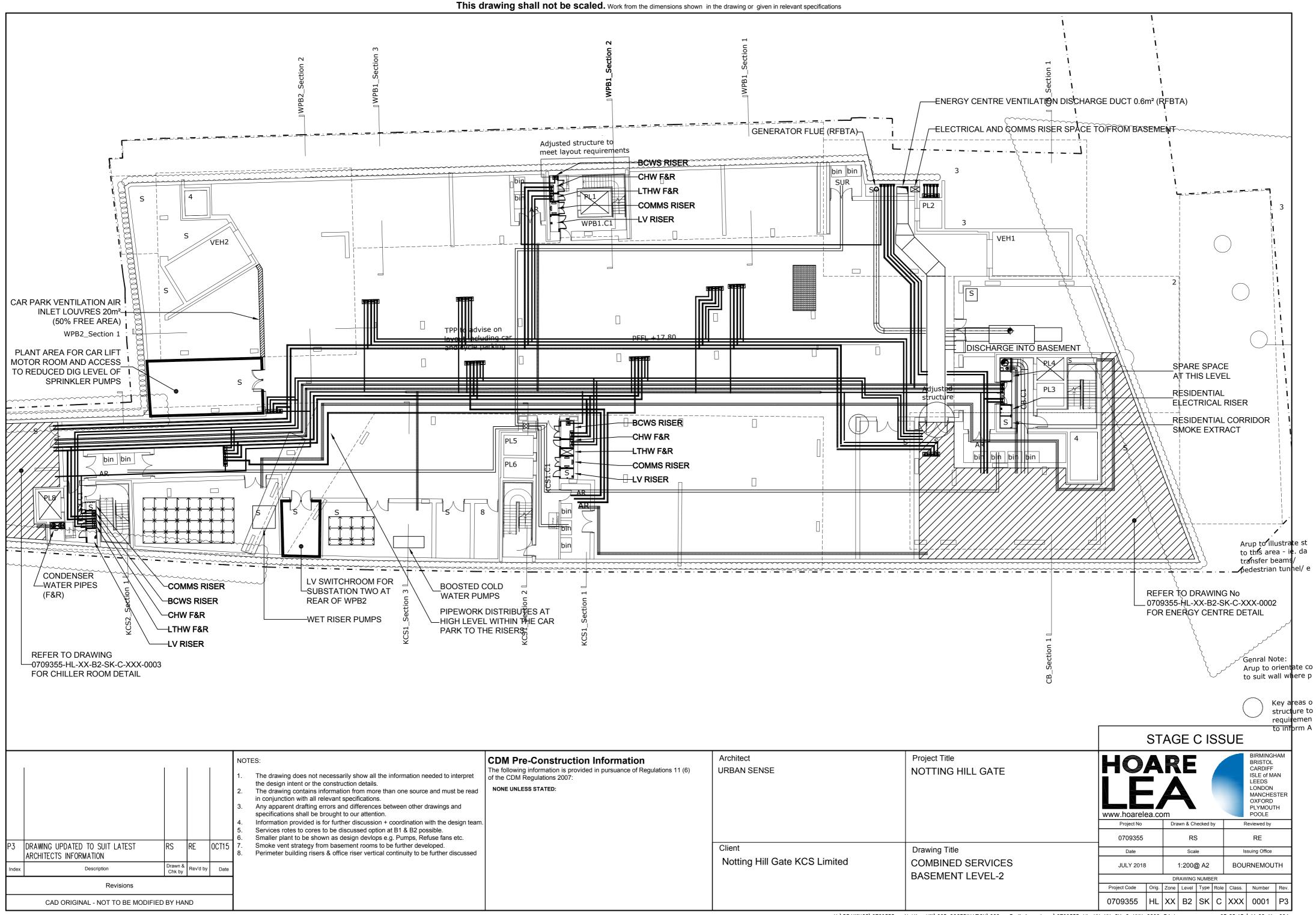
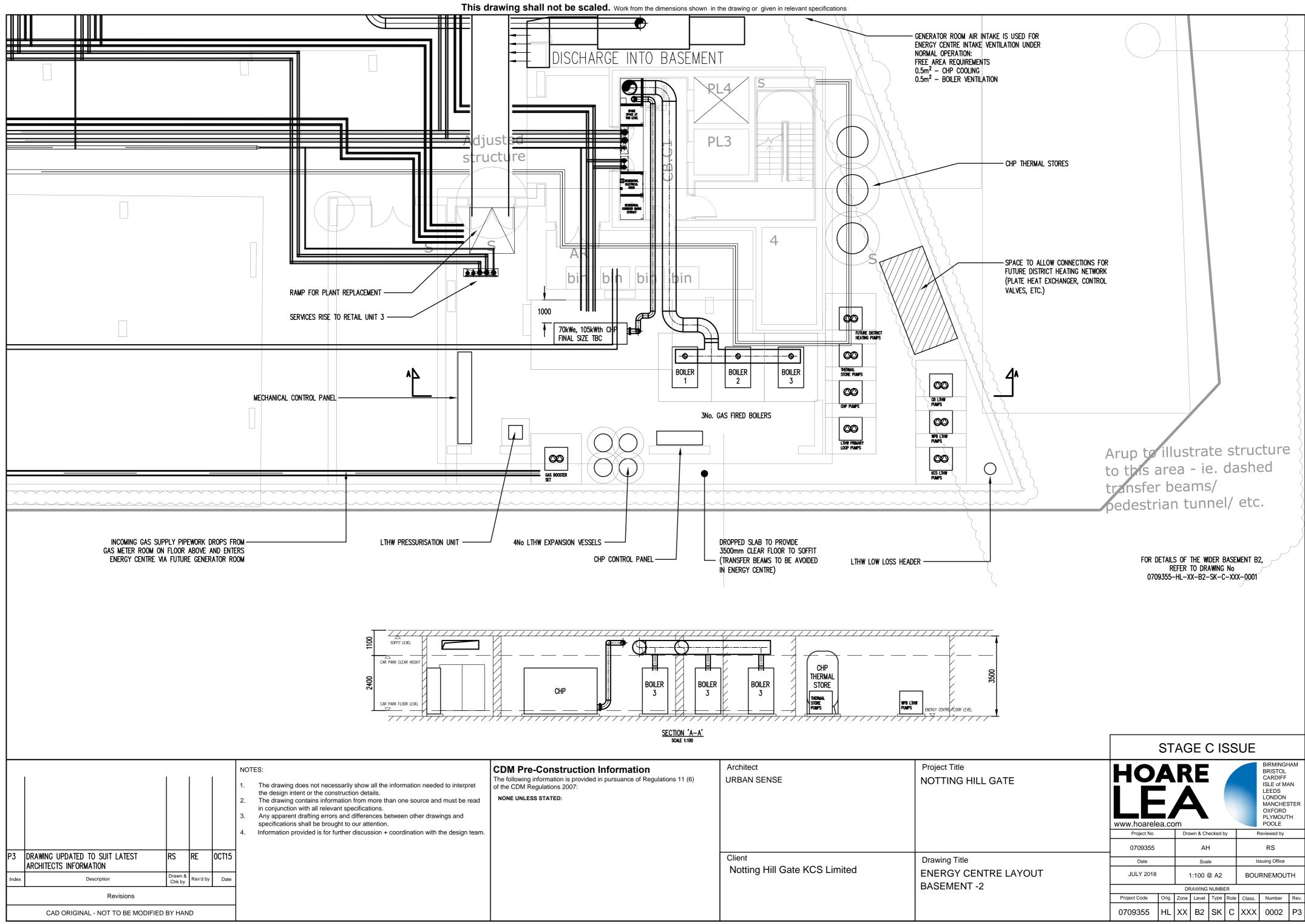
Newcombe House and Kensington Church Street Energy Strategy Addendum July 2018

**APPENDIX 4 – SITE WIDE SCHEMATICS** 



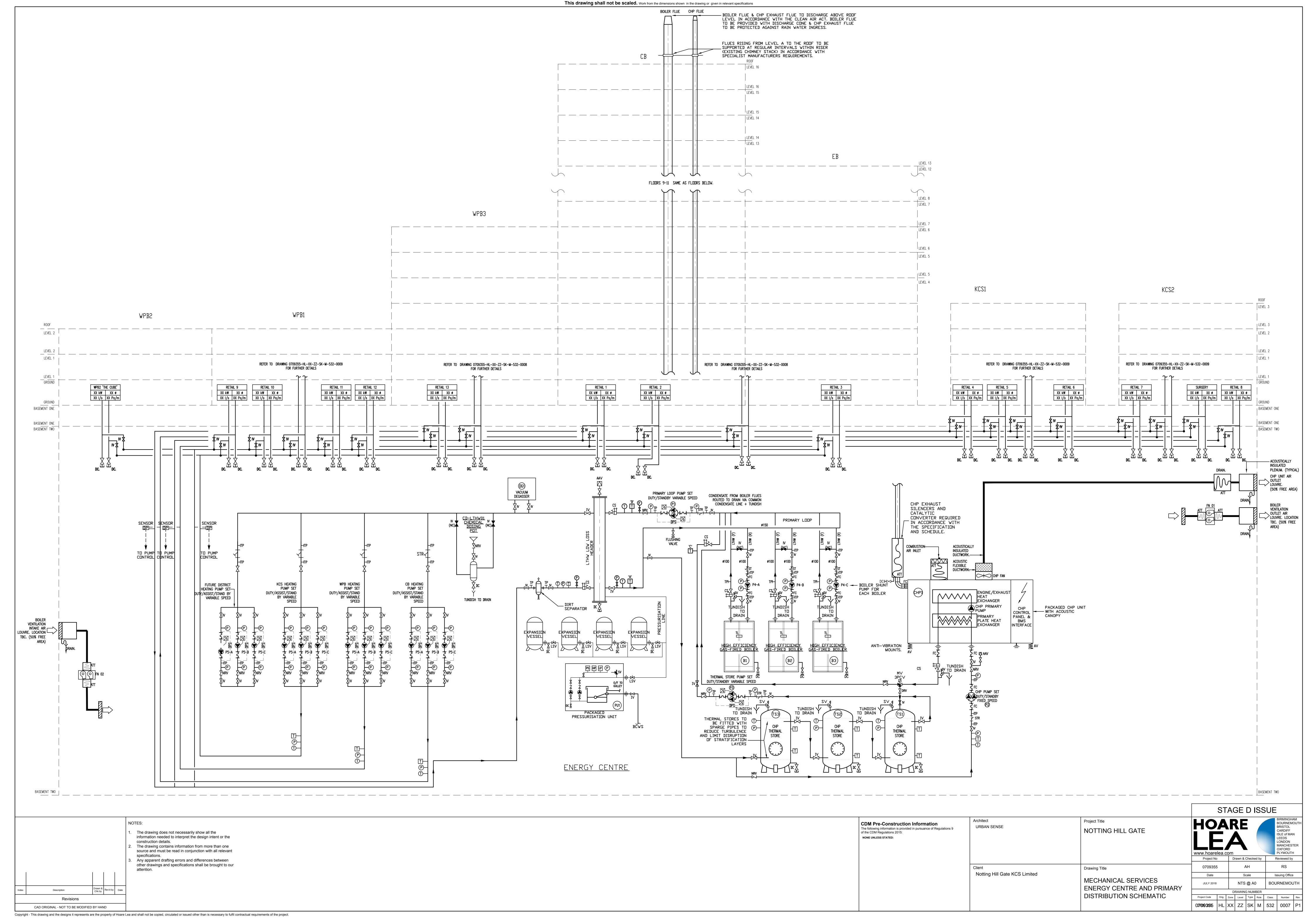
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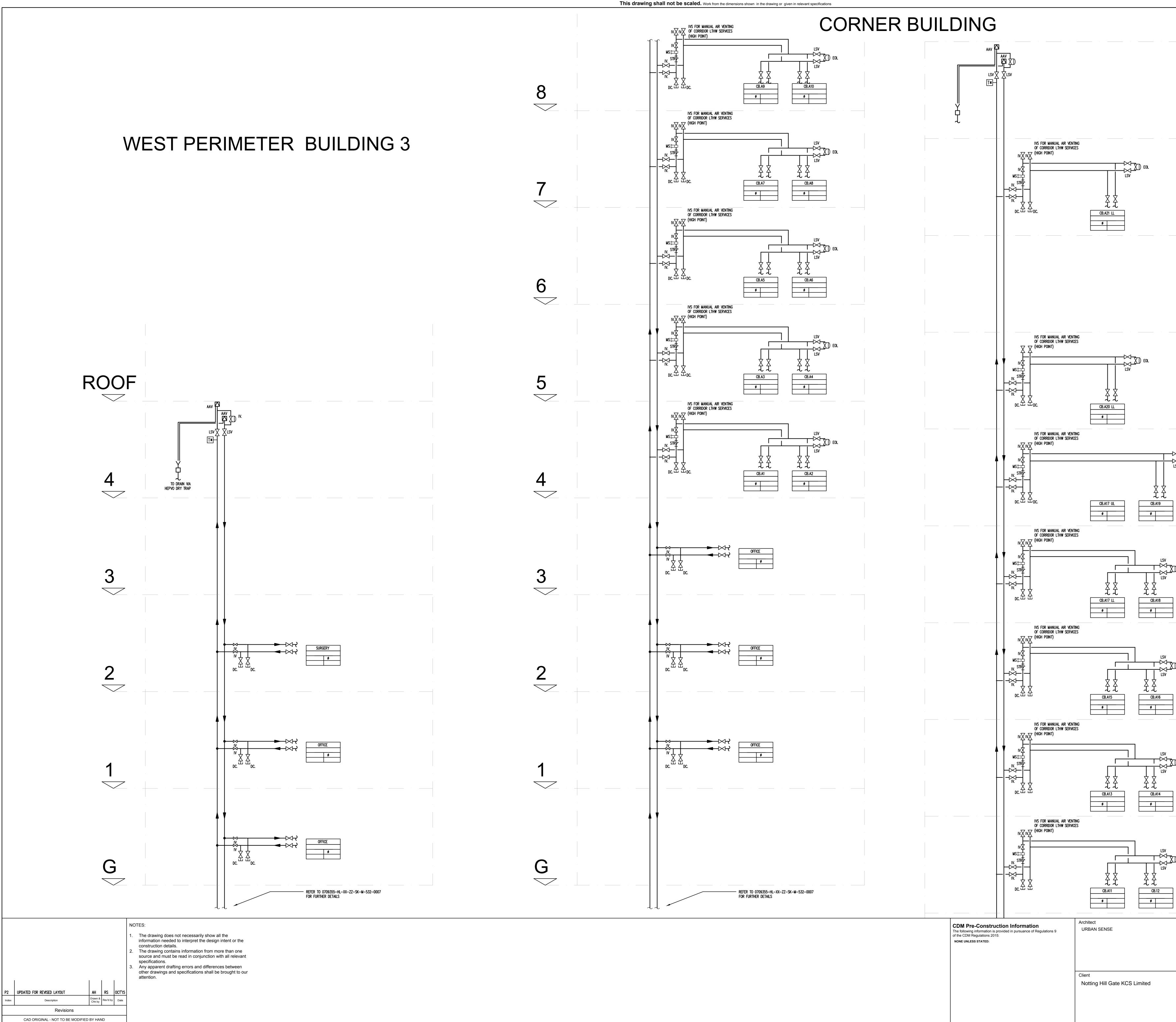
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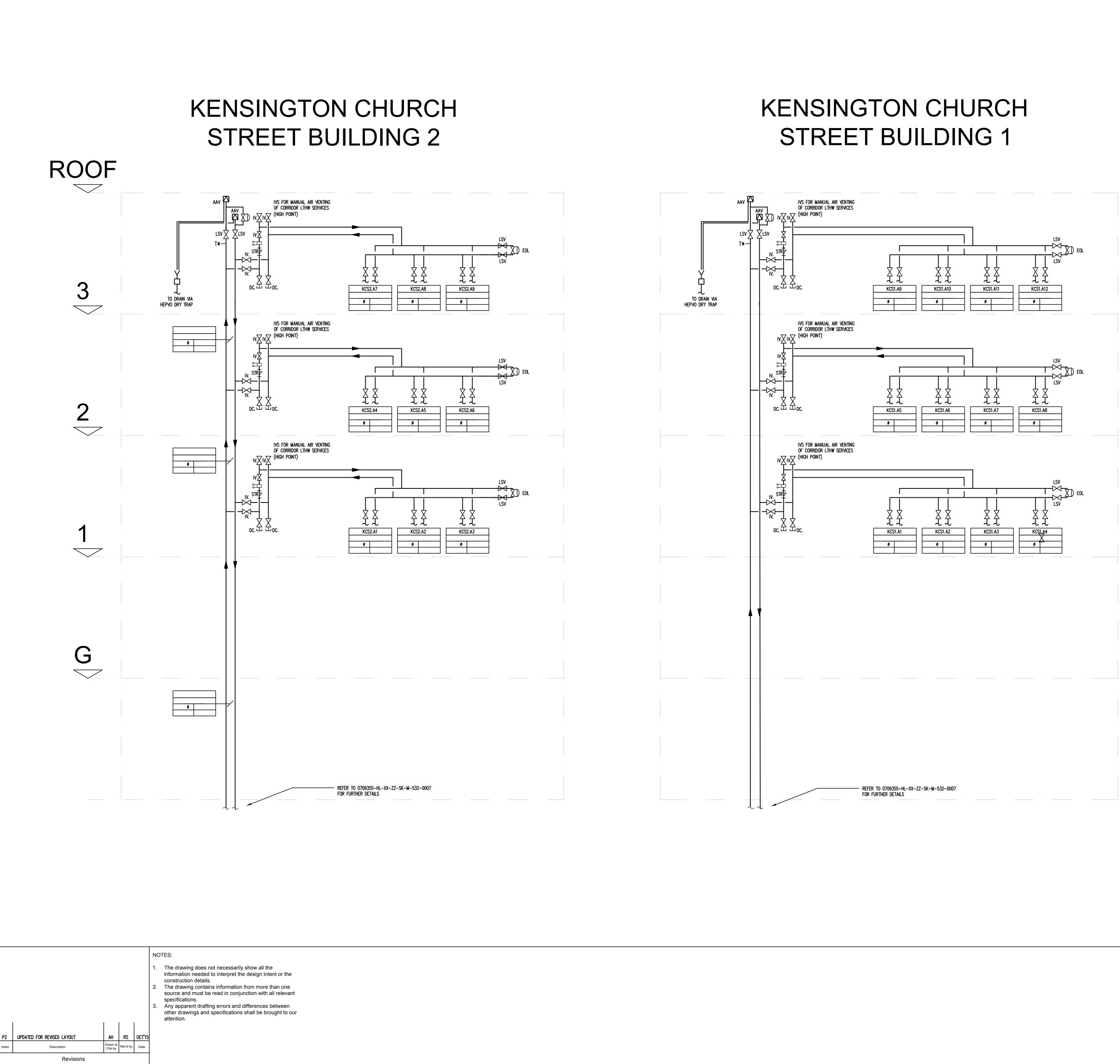
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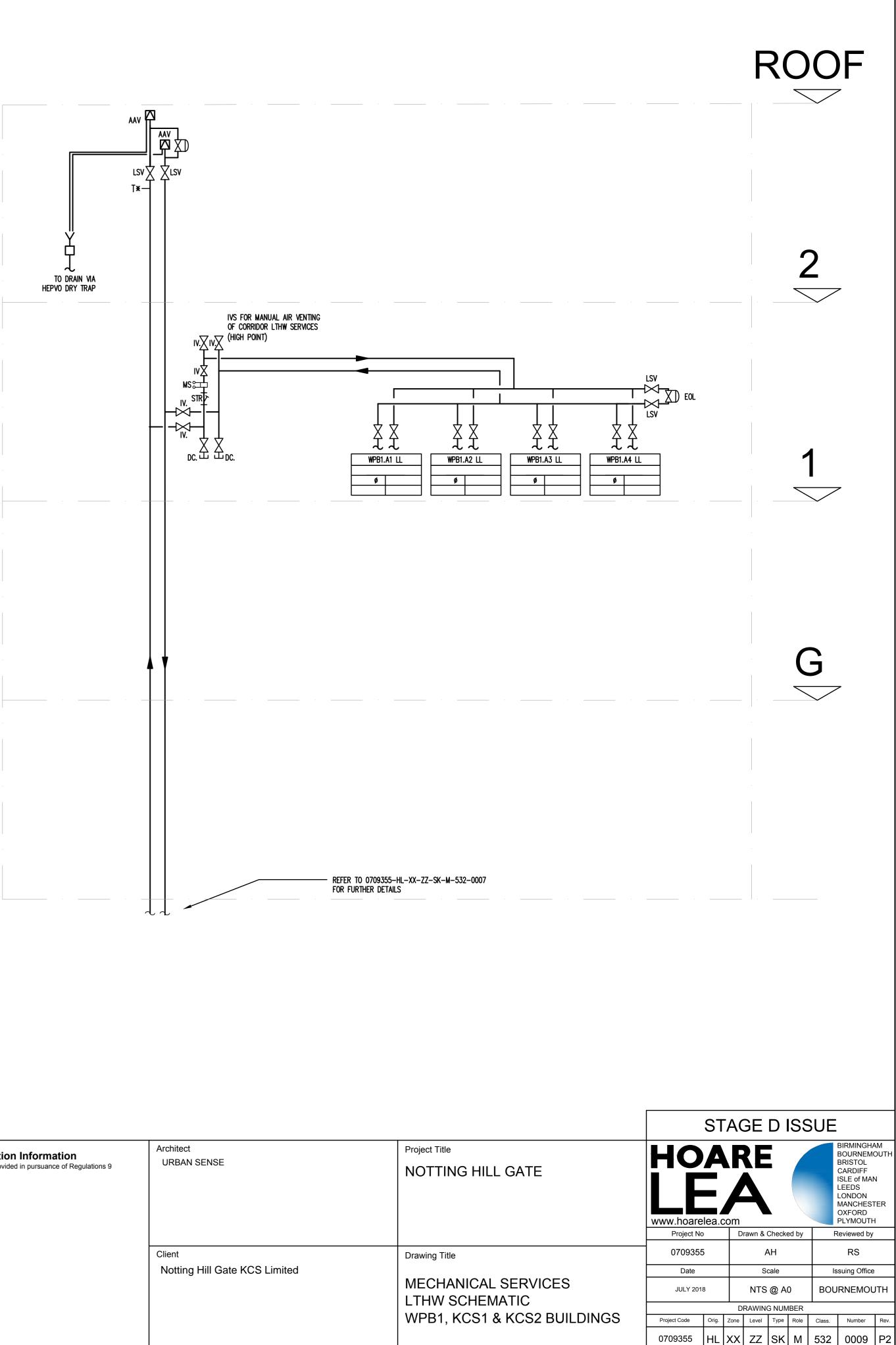


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CDM Pre-Construction Information The following information is provided in pursuance of Regulations 9 of the CDM Regulations 2015: NONE UNLESS STATED:

**APPENDIX 5 – SAMPLE 'BE CLEAN' DER WORKSHEETS & BRUKL DOCUMENTS** 

Energy Strategy Addendum

hoare lea (H.)

Project	Newcombe House - CB (CLEAN)
Revision	2
Version	8
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
CB-A1	164.79	1	15.66	10.74	-31.40%	58.90	54.40	-7.65%	1.5	Medium
CB-A17 Duplex	333.64	1	14.86	9.94	-33.13%	64.95	61.11	-5.91%	1.9	Medium
CB-A2	162.36	1	16.50	11.80	-28.53%	62.82	59.04	-6.02%	1.4	Medium
CB-A20 Duplex	365.9	1	13.92	9.27	-33.40%	60.95	56.66	-7.03%	1.9	Medium
CB-A21 Duplex	367.27	1	19.28	13.20	-31.55%	88.15	85.58	-2.92%	2.4	Medium
CB-A3	164.79	2	13.28	8.92	-32.88%	47.03	42.64	-9.35%	1.8	Medium
CB-A4	162.81	2	14.22	10.09	-29.05%	51.49	48.22	-6.35%	1.9	Medium
CB-A7	165.65	5	13.45	9.02	-32.98%	48.12	43.51	-9.59%	1.9	Medium
CB-A8	162.21	7	14.58	10.32	-29.25%	53.32	49.72	-6.75%	1.9	Medium
Area Weighted Results	4012.88	21	14.73	10.13	-31.23%	57.05	53.17	-6.80%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m <sup>2</sup> K)	0.25	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
External Eabric	Roof U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
			Based on Construction of Walls, Floors, Roofs (including party and internal
Thermal Mass	Thermal Mass Parameter (Simple) Thermal Bridge Specification	Low Default	floors and ceilings) No further information required on thermal bridges
Thermal Bridging	Thermai Bridge Specification	Derault	As stated on a test certificate from a person registered by an authorised
Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure te If a dwelling is not pressure tested the value used in the calculation is an av of the tested dwellings of the same type plus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. B Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compone together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	
-	Boilers - Fraction of Heat (-)	0.3	As design specification
-	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
-	CHP - Fraction of Heat (-)	0.7	As design specification
-	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54 Pre-insulated low	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
-	Emitter	Underfloor (Screed)	
	Туре	From Main System	
	Cylinder in Dwelling	No	
		NO V	
	Plate Heat Exchanger	Yes	
Water Heating	Volume (litres)	1	
2	Insulation Type	Spray Foam	
	Insulation Thickness (mm)	30	
	Waste Water Heat Recovery	No	
Renewables	Туре	None	
	Areas Cooled	All Living Spaces and Bedrooms	
Cooling	EER	4.5	
	Controls	Variable Speed Compressor	
		No	
	Openable Windows		
Summertime Overheating	Mechanical Ventilation Required	Yes Light-coloured curtain or	

hoare lea (H.)

Project	Newcombe House - KCS1 (CLEAN)
Revision	2
Version	8
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
KCS1-A1	175.68	1	15.16	9.95	-34.40%	57.80	51.95	-10.12%	1.8	Medium
KCS1-A10	42.3	1	21.78	15.75	-27.68%	58.86	66.26	12.57%	2.9	Medium
KCS1-A11	151	1	13.73	8.75	-36.24%	48.00	41.09	-14.40%	2.2	Medium
KCS1-A12	58.88	1	17.09	11.41	-33.22%	44.17	42.11	-4.66%	2.6	Medium
KCS1-A13	183.45	1	15.89	11.26	-29.14%	62.25	59.91	-3.76%	2	Medium
KCS1-A14	151	1	16.04	11.21	-30.10%	59.61	57.18	-4.08%	2.2	Medium
KCS1-A15	58.88	1	19.40	13.80	-28.85%	55.76	57.64	3.37%	2.2	Medium
KCS1-A2	42.3	1	21.78	14.64	-32.79%	58.86	62.44	6.09%	3	Medium
KCS1-A3	143.5	1	16.35	10.65	-34.87%	60.02	53.47	-10.91%	1.8	Medium
KCS1-A4	58.88	1	19.40	12.72	-34.42%	55.76	53.44	-4.16%	2.3	Medium
KCS1-A5	175.68	1	12.79	8.41	-34.25%	46.04	40.28	-12.51%	2.1	Medium
KCS1-A6	42.3	1	19.52	13.60	-30.36%	47.32	52.20	10.30%	3.3	Medium
KCS1-A7	143.5	1	14.00	9.07	-35.17%	48.26	41.87	-13.25%	2.1	Medium
KCS1-A8	58.88	1	17.09	11.41	-33.22%	44.17	42.11	-4.66%	2.6	Medium
KCS1-A9	183.45	1	13.48	8.81	-34.66%	50.16	43.90	-12.49%	2.1	Medium
Area Weighted Results	1669.68	15	15.64	10.49	-32.92%	53.54	49.66	-7.25%		0

Internal Modes         Interna	Category	Parameter	Value	Notes
Ream al Failor         Read U Value (WmR)         0.18         A Calculated by 85 EN ISO 4946           Garng U Value (WmR)         1.10         N Calculated by 85 EN ISO 4946           Garng U Value (WmR)         0.30         No calculated by 85 EN ISO 4946           Internal Walts         For Other Apartments         Full Flat Carls with Sould Edges         No calculated by 85 EN ISO 4946           Internal Walts         To Other Apartments         Full Flat Carls with Sould Edges         No calculated by 85 EN ISO 4946           To To Stary Welk (WmR)         0.18         A Calculated by 85 EN ISO 4946           To To To Stary Welk (WmR)         0.18         A Calculated by 85 EN ISO 4946           To To This Stary Welk (WmR)         0.18         A Calculated by 85 EN ISO 4946           To To This Stary Welk (WmR)         0.18         A Calculated by 85 EN ISO 4946           Thermal Mass Tammer Gimple         Low         Bised on Canculated by 85 EN ISO 4946           Thermal Mass Tammer Gimple         Low         Bised on Canculated by 85 EN ISO 4946           Ar Permeability         Ar Permeability Rate (InStruct 2004)         3           Ar Permeability         Strategy         Balanced with Heat Record (SER 74 PCH 40 FGH		External Wall U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
External Factor         Caladian Guy Value (WrinizX)         1.10         Ac Calculated by SEN ISO 2267 or 10077 UV-Value (Includes glas and frame)           Guy Agenetic         0.55         UV-Value (Includes glas and frame)           Internal Walls         To Other Apartments         Fully Field Carly with Sealed Edgas         Propertion of glass to overall opening size           Internal Walls         To Corrisos (Wrin/Y)         0.18         Ac Calculated by SE NISO 6446           To To Har Apartments         To To Har Mass Stander (Sing Biol To Sale Velock (Wrin/Y)         0.18         Ac Calculated by SE NISO 6446           Thermal Mass         Thermal Mass Stander (Sing Biol To Sale Velock (Wrin/Y)         0.18         Ac Calculated by SE NISO 6446           Thermal Mass         Thermal Mass Stander (Sing Biol To Sale Velock (Wrin/Y)         0.18         Ac Calculated by SE NISO 6446           Air Permaal Bridging         Thermal Mass Stander (Sing Biol Sale Carl Calculated Sing Sing Calculation and Calling Sing Calculation and Calling Sing Calculation and Calling Sing Calculation and Calling Sing Calculation and Calculation and Calling Sing Calculation and Calling Sing Calculation and Calculation and Calling Sing Calculation and Calling Sing Calculation and Calculation a		Floor U-Values (W/m²K)	0.09	As Calculated by BS EN ISO 6946
Gaung U-Value W/m2(0)         1.10         Ar Calculated by SEN 100 225 or 10077           IV Area Includes plass and frame         G-Value V/m2(0)         0.055           Internal Walt         To Other Apartments         Full / Field Carly with Sealed Edges         Ar Calculated by RE FIN 50 046           To Cortise W/m2(0)         0.18         Ar Calculated by RE FIN 50 046         Ar Calculated by RE FIN 50 046           To Earnal Walts         To Cortise W/m2(0)         0.18         Ar Calculated by RE FIN 50 046           To Earnal Mass         Thermal Mass frammeter Gimple)         Unw         Second Calculated by RE FIN 50 046           Thermal Bridge         Thermal Mass frammeter Gimple)         Unw         No further information regimer by an authorize for particulated for MR 100 0466           Thermal Bridge         Thermal Bridge Specification         Default         No further information regimer by an authorize for particulate for MR 100 0466           Ar Permeability         Ar Permeability Ref (m3/hm2 at 50P)         3         Ar Stated on a set certificate from apsociate may an authorize for particulate of the wale used in the calculated by RE FIN 50 0466           Ar Permeability         Ar Permeability Ref (m3/hm2 at 50P)         3         Ar State on a set certificate from apsociate may an authorize for particulate on a set certificate from apsociate may an authorize for particulate on a set certificate from apsociate may an authorize for Particulate on a set certificate from apsociate may an	Extornal Eabric	Roof U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
C-Value ()         0.03         Proceeding (M)         0.03           Internal Works         To Other Apartments         Fully Field Cridy with Saved Edges         Acceleration of glass to overall opening size           Internal Works         To Corridos (W) m/N         0.18         Ac Calculated by ISE IN ISO 0494           To To Enror Work (W)         0.18         Ac Calculated by ISE IN ISO 0494           To To Hir Short (W) m/N         0.18         Ac Calculated by ISE IN ISO 0494           Thermal Mass         Thermal Mass Fazameter (Simple)         Low         Bieled on Construction of Walk, Floors, Rock (Findering party and Internat Income and cellings)           Thermal Mass         Thermal Mass Fazameter (Simple)         Low         Bieled on Construction of Walk, Floors, Rock (Findering party and Internat Income and cellings)           Air Permeability         Air Permeability Rate (Inf./Intr.2 at 50Pa)         3         No Entither information requires the tabulations in a difference (Intr.2 at V-2 40) KG3           Kechanical Ventition         SFP W/W/D)         0.32 K+21, 63 K+21, 63 K+21, 64 K         SAP Appendix Q Text Results           Kechanical Ventition         Inteller Appendix Q Text Results         SAP Appendix Q Text Results         SAP Appendix Q Text Results           Kechanical Ventition         Intel Cachange Efficiency (N)         92 K+01 (69 K+01 (5) K+21 (64 K+01 (6)	External Fabric	Glazing U-Value (W/m2K)	1.10	
Factor Glass (%)         0.00         Proportion of glass to overall opening size           Internal Wate         To Other Apartments         Fully Filled Carly with Sealed Edges         Acceluted by DS EN ISO 6946           To Romer WUMWA         0.18         Ac Calculated by DS EN ISO 6946         Acceluted by DS EN ISO 6946           To Uth Statis (WiMVA)         0.18         Ac Calculated by DS EN ISO 6946         Acceluted by DS EN ISO 6946           Thermal Mass         Thermal Mass Parameter (Single)         Low         Back on Construction of Wilk-Floors, Rods in function graph and internal floora on delings)           Thermal Mass         Thermal Bridge Specification         Default         No further information required on thermal bridges           Air Permeability         Air Permeability Date (m3/hm2 at SOP)         3         No further information required on thermal bridges           Air Permeability         Air Permeability Date (m3/hm2 at SOP)         3         No further information required on thermal bridges           Actalet on the calculated by Difference         SSFP (WU/s)         0.52 (k+1) (s) (CS, k+2) (s) (CS)         SAP Appendix Q Test Results           Arehanical Ventilition         SFP (WU/s)         0.52 (k+1) (s) (CS, k+2) (s) (CS)         SAP Appendix Q Test Results           Arehanical Ventilition         SFP (WU/s)         0.52 (k+1) (s) (CS, k+2) (s) (CS)         SAP Appendix Q Test Results		G-Value (-)	0.55	(o valae meddes glass and mane)
Internal Walts         To Control Aquatinities         Sealed Edges           Internal Walts         To Rivers WUrWig         0.18         Ac Calculated by ISS IN ISO 6/46           To Unit Aquatinities         0.18         Ac Calculated by ISS IN ISO 6/46           To To IS shart Wells (WUrWig)         0.18         Ac Calculated by ISS IN ISO 6/46           Thermal Bridging         Thermal Bridging         Thermal Bridging         Read on Construction of Wilks, Floors, Reods finculating party and Internal Bridging           Air Permeability         Air Permeability Rate (m3/hm2 at S0%)         3         Not exist on each eneromical area exist entiticate from a sent entiticate from and wheeling party and Internal Bridging           Air Permeability         Air Permeability Rate (m3/hm2 at S0%)         3         Nate to use the measured air perm rate acting scheme by a file acting the parts at exist entiticate from a sent entiticate from a sent entiticate from and wheeling parts at the person of the test develop on at test entiticate from as a set entiticate from as a set entiticate from as a set entiticate from as at test entiticate from as at the entiticate from at test entiticate from at test entiticate from as at the entiticate from at test entiticate from at the test at the person of the test develop on at the test develop on at the test develop on at test entiticate from at test entitest at test entiticate from attest entitest entits at test enti		Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
Internal Walls         To Corridors (Wink)         0.18         Ac Calculated by BSE NIS 06 0446           To Ditt Starts (Wink)         0.18         Ac Calculated by BSE NIS 06 0446           To Litt Starts (Wink)         0.18         Ac Calculated by BSE NIS 06 0446           Thermal Mass         Thermal Mass Parameter (Simple)         Low         Based on Construction of Walls, Floors, and celling: Corridors (Wink)           Thermal Bridging         Thermal Bridge Specification         Default         No further information regords including party and internal bridges           Air Permeability         Air Permeability Rate (m3/hm2 at 50%)         3         No further information regords including that to be pressure to and celling scheme           Air Permeability         Air Permeability Rate (m3/hm2 at 50%)         3         No further information regords including that to be pressure to and celling scheme           Action Construction of Walls, Floors, Ark, Bok (AS)         SPP Appendix Q Test Results         Note to use the messared and scheme part of the installer approved (KR, KR, KR, KR, Bok (AS)         SPP Appendix Q Test Results           Attended Ves         Installer approved         Yes         Ductwork installer approved (KR, KR, KR, KR, Bok (AS)         SPP Appendix Q Test Results           Attended Ves         Corregord         Corregord         Corregord         Ductwork installer approved (KR, KR, KR, KR, Bok (AS)         SPP Appendix Q Test Results         <		To Other Apartments		
Internal Walls         To Risers Wurking         0.18         Ac Calculated by RSE NISO 6946           To UIS Trains Wurking         0.18         Ac Calculated by RSE NISO 6946           Thermal Mass         Thermal Mass Parameter (Single)         Low         Based on Construction of Walls, Poors, Roots functionating party and Internat floors and cellingal           Thermal Bridging         Thermal Bridging         Thermal Bridging Specification         Default         No further Information required on thermal bridging resource testing scheme           Air Permeability         Air Permeability Rate (m3/hm2 at 50%)         3         As Stated on a test certificate from ascheme registered by an authorise of the tested develope on thermal bridging           Air Permeability         Air Permeability Rate (m3/hm2 at 50%)         3         As Stated on a test certificate from ascheme registered by an authorise of the tested develope on the collication is an expensive of the collication of the scalability and the collication is an expensive of the collication of the collicat		To Corridors (W/m <sup>2</sup> K)		As Calculated by BS EN ISO 6946
Thermal Mass         Thermal Mass         Thermal Mass         As Calculated by St FN ISO 4946           Thermal Mass         Thermal Mass Parameter Simple         Low         Based on Construction While, Foos, Social chaining and mitterns and cellings)           Thermal Bridging         Thermal Miss Parameter Simple         Default         No further information required on thermal bridges           Air Permeability         Air Permeability Rate (m3/hm2.at 50Pa)         3         No further information required in the anal kindness pressure testing scheme           Air Permeability         Strategy         Balanced with Heat Recovery         No to use the massured air perm rate ach dwelling is not be pressure to the calculation is an a contract the contract ach dwelling is not be pressure to the calculation is an a contract the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be pressure to the calculation is an a contract ach dwelling is not be calcula	Internal Walls			
Thermal Mass         Thermal Mass Parameter (Simple)         Low         Based on Construction of Walk, Paces, Roof, Binckling party and Interna Boors and celling)           Thermal Bridge Specification         Default         No further information required on thermal bridges. Are Permeability         Air Permeability Rate (m3/hm2 at 50Pa)         3         No further information required on thermal bridges. Are stated on a test cellicate from a person registered by an authorized pressure testing scheme and of the tested dwelling of the scale schedulants is an of the tested dwelling to the scale schedulants is an of the tested dwelling to the scale schedulants of the restered schedulants of the value used in the calculation is an of the tested dwelling to the scale schedulants of the restered schedulants of the value used in the calculation is an of the tested dwelling to the scale scheduling of the scale schedulants of the restered velocity. The value used in the calculation is an of the tested dwelling to the scale schedulants of the restered velocity. The value used in the calculation is an of the tested dwelling to the scale scale the restered velocity. The value used in the calculation is an of the tested dwelling to the scale scale the restered velocity. The value used in the calculation is an of the tested dwelling to the scale scale the restered velocity. The value used in the calculation is an of the tested dwelling to the scale scale the restered velocity. The value used to be invalued if all of the ductwork is first in unnovalued.           Adductwell is difficulty.         Ductwork is first in unnovalued.         Ductwork is first in unnovalued.           Ductwork instalted rest the calculation is an of the tested dwelling scale scale scale scale scale scale scale scale is an of the ductrescale scale scale is a		To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Initial was         Initial was         Initial was         Initial was         Initial was           Thermal Bridging         Thermal Bridging         Thermal Bridging         No further information required to thermal bridges           Air Permeability         Air Permeability         Air Permeability         Strategy         Balanced with Heat Recovery           Strategy         Balanced with Heat Recovery         No further information required in the calculation is an of the tested dwelling soft the same type pile 2.           Are Permeability         Strategy         Balanced with Heat Recovery         SAP Appendix Q Test Results           Strategy         Balanced with Heat Recovery         SAP Appendix Q Test Results         SAP Appendix Q Test Results           Arehanical Ventilation         Installer approved         Yes         Balanced with Heat Recovery           Installer approved         Yes         The installer has be registered with a Government Approved Scheme e.g. EBue Fluence Cettification, Cetture, NAPT and Stroan           Ductwork Insulated         Installer approved         Yes         The installer has be registered with a Government Approved Scheme e.g. EBue Fluence Cettification, Cetture, NAPT and Stroan           Bolers - Friction PHeat (1)         0.3         Ac actalant PHE ductwork is Ridd in the ductwork is Ridd in the ductwork is Ridd insulated involuted insulated involuted insulated involuted insulated involuted insus           Space Heating </td <td></td> <td>To Stair Wells (W/m<sup>2</sup>K)</td> <td>0.18</td> <td></td>		To Stair Wells (W/m <sup>2</sup> K)	0.18	
Themail Bridging         Themail Bridging         Themail Bridging         Themail Bridging         Themail Bridging         Themail Bridging         Note that the information required on themail bridges           Air Permeability         Air Permeability Rate (m3/hm2 at 50Pa)         3         As stated on a sets certification required on themail bridges           Air Permeability         Strategy         Balanced with Heat Recover (K+3, 74 K+4), 85 (K+5)         Note to use the registered with each sheet (properties and of the tested dwellings of the same type plus 2.           Kechanical Ventilation         Strategy         Balanced with Heat Recover (S+3, 74 K+4), 85 (K+5)         SAP Appendix Q Test Results           Mechanical Ventilation         1nstaller approved         Yes         The installer has be registered with a doveling to be invaliated for an automated           Mechanical Ventilation         Installer approved         Yes         SAP Appendix Q Test Results           Duct Type         Bigd         All ductwork is rigid escept for occasional flexible ducting to join compor together           Duct type         Bigd         All ductwork is rigid escept for occasional flexible ducting to join compor together           Duct type         Bigd         All ductwork is rigid escept for occasional flexible ducting to join compor together           Balance Settification         Category         Commanil         As design specification           CHP - Friction	Thermal Mass		Low	Based on Construction of Walls, Floors, Roofs (including party and internal
Air Permeability         Air Permeability Rate (m3/hm2 at 50Pa)         3         As stated on a test certification is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value of the calculation is an authorise pressure tested the value of the calculation is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value of the calculation is an authorise pressure tested the value of the calculation is an authorise pressure tested the value of the calculation is an authorise pressure tested the value used in the calculation is an authorise pressure tested the value used in the calculation is an authorise of the average pressure tested the value used in the calculation is an authorise pressure tested the value used in the calculation is an authorise of the value of the section of the sectin of the section of the section of the section of the s				
Air Permeability         Air Permeability Rate (m3/hm2 at 50Pa)         3         permeasured air permit are activations in an output persure 1 for a develop in a to be pressure 1 for a develop in a to be pressure 1 for a develop in a to be pressure 1 for a develop in a to be pressure 1 for a develop in the calculation is an a output persure 1 for a develop in the calculation is an a develop in the calculation in the calculation is an intervent in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation is an intervent in the calculation in the calculation in the calculation is a develop in the calculation in the calculatin the calculation in the calculatin the calculation	Thermal Bridging	Thermal Bridge Specification	Derault	
SFP (W//s)         0.52 (K+1), 0.55 (K+2), 63 (K+3), 72 (K+4), 89 (K+3) 89 (K+4), 89 (K+3)         SAP Appendix Q Test Results           Aechanical Ventilation         Installer approved         Yes         SAP Appendix Q Test Results           Duct Type         Rigid         All ductwork is rigid except for coassional field leaching to join comport together         Duct Type         Rigid         All ductwork is rigid except for coassional field leaching to join comport together           Duct Type         Rigid         All ductwork is rigid except for coassional field leaching to join comport together           Boilers - Fraction of Heat (-)         0.3         As design specification           Boilers - Fraction of Heat (-)         0.3         As design specification           Boilers - Fraction of Heat (-)         0.7         As design specification           Boilers - Fraction of Heat (-)         0.7         As design specification           CHP - Heat Dower Ratio (-)         1.54         Heat Supplied / Power Supplied           Fraction of Heat (-)         0.7         As design specification           CHP - Heat Dower Ratio (-)         1.54         Heat Supplied / Power Supplied           Heat Distribution System         thereinsusted low         District heating specification           Controls         Carging system linked to use, programmer and Tixy         Spray Foam           Water	Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure t If a dwelling is not pressure tested the value used in the calculation is an av
Activity         (K+3),74 (K+4),86 (K+5)         SMP Appendix Q Test results           Activation         Heat Exchange Efficiency (%)         92 (K+1),92 (K+2),90 (K+3), 89 (K+4),89 (K+2),90 (K+3),90 (K+3),90 (K+3),90 (K+3),90 (K+3),90 (K+4),90 (K+3),90 (K+3)		Strategy	Balanced with Heat Recovery	
Prior         BY (k+4), BY (k+5)         SAVE Appendix Q risk results           Aechanical Ventilation         Installer approved         Yes         The installer has be registered with a Government Approved Scheme e.g. E Blue Fame Certification, Certisue, IAVPT and Stroma           All ductwork is rigid except for occasional flexible ducting to join compor together         All ductwork is rigid except for occasional flexible ducting to join compor together           Boilers - Fraction of Heat ()         0.3         As design specification           Boilers - Fraction of Heat ()         0.3         As design specification           CHP - Fraction of Heat ()         0.3         As design specification           Boilers - Efficiency (%)         9.1.8         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           Charging system linked to use, programmer and TRVs         District heating specification           Value (Uters)         1         Heat District heating specification           Path Heat Exchanger         Yes         Insulation Type           Volume (Uters)         1 <td< td=""><td></td><td>SFP (W/I/s)</td><td></td><td>SAP Appendix Q Test Results</td></td<>		SFP (W/I/s)		SAP Appendix Q Test Results
Installer approved         Yes         The industrial metagener contrast, paper during the second sec		Heat Exchange Efficiency (%)		SAP Appendix Q Test Results
Duck type         Ngd         together           Duckwork insulated         Yes         Duckwork can be assumed to be insulated if all of the duckwork is inside insulated ervelope even if the duckwork is inside	Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. E Blue Flame Certification, Certsure, NAPIT and Stroma
Luctivork insulated         Yes         insulated envelope even if the ductwork itself is uninsulated.           Boilers - Fraction of Heat ()         0.3         As design specification           Boilers - Fraction of Heat ()         0.7         As design specification           Boilers - Efficiency (%)         91.8         As calculated by SAP Appendix D           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         0.7         As design specification           CHP - Fraction of Heat ()         1.54         Heat Supplied           CHP - Heat to Power Ratio ()         1.54         Heat Supplied           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Controls         Charging system         No         Power Supplied           Value Heat Excharger         Yes         1         Volume (itres)           Volume (itres)         1         Insulation Trype         Spray Foam           Insulation Trype         No         Private Units have Confort Cooling           Value Heat Recovery         No         Areas Cooled         Al Living Spaces and Befrorable Units have comfort Cooling           EER		Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compon together
Boilers - Fraction of Heat (-)         0.3         As design specification           Boilers - Fraction of Heat (-)         0.7         As design specification           CHP - Fraction of Heat (-)         0.7         As design specification           CHP - Fraction of Heat (-)         0.7         As design specification           CHP - Heat to Power Ratio (-)         1.54         Heat Supplied / Power Supplied           CHP - Heat to Power Ratio (-)         1.54         Heat Supplied / Power Supplied           Controls         Chrange system linked to (1991 or later)         District heating specification           Controls         Charging system linked to use programmer and TRVs         District heating specification           Value (litres)         1         No         Plate Heat Exchanger           Plate Heat Exchanger         Yes         Volume (litres)         1           Water Heating         Insulation Type         Spray Foam         Spray Foam           Renewables         Type         No         Private Units have Confort Cooling Affordable Units have no Comfort Cooling           Cooling         EER         4.5         Controls No           Summertime         Openable Windows         No         Private Units have comfort Cooling Affordable Units have no Comfort Cooling Affordable Units have no Comfort Cooling           Sum			Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
Boilers         Efficiency (%)         91.8         As calculated by SAP Appendix D           CHP - Fraction of Heat (-)         0.7         As design specification           CHP - Efficiency (%)         80         Gross Efficiency from Manufactures Literature           CHP - Efficiency (%)         80         Gross Efficiency from Manufactures Literature           CHP - Heat to Power Ratio (-)         1.54         Heat Supplied / Power Supplied           Heat Distribution System         Pre-insulated low temperature, variable flow (1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Value Heat Exchanger         Ype         From Main System           Cylinder in Dwelling         No         Plate Heat Exchanger           Value (Hres)         1         1           Value (Hres)         1         Insulation Type           Insulation Type         Spray Foam         Private Units have Comfort Cooling           Renewables         Ype         None           Yuable Speed Compressor         Areas Cooled         AllLing Spaces and Bedrooms           Cooling         EER         4.5         Confort Cooling           EER         4.5         Contols         Vatable Speed Compressor				
CHP - Fraction of Heat (-)         0.7         As design specification           CHP - Entition of Heat (-)         80         Gross Efficiency from Manufacturers Literature           CHP - Heat to Power Ratio (-)         1.54         Heat Supplied / Power Supplied           Space Heating         CelP - Heat to Power Ratio (-)         1.54           Heat Distribution System         Pre-insulated low temperature, variable flow (-1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Emitter         Underfloor (Screed)         District heating specification           Variable         Cylinder in Dwelling         No           Plate Heat Exchanger         Yes         1           Volume (litres)         1         1           Insulation Truckenss (nm)         30         Water Heating           Renewables         Type         None           You wate Water Heat Recovery         No         Areas Cooled           EER         4.5         Control Bedrooms           Cooling         EER         4.5           Cooling         EER         4.5           Cooling         EER         4.5           Cooling         EER         4.5				
CHP - Felticiency (%)         80         Gross Efficiency from Manufacturers Literature           Space Heating         CHP - Heat to Power Ratio (1)         1.54         Heat Supplied / Power Supplied           Space Heating         Heat Distribution System         Pre-insulated low temperature, variable flow (1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Mater Heat Distribution System         From Main System         From Main System           Controls         Charging system linked to use, programmer and TRVs         From Main System           Value flow         From Main System         Controls         Controls           Value flow         Spray Foam         Spray Foam         From Main System           Water Heating         Insulation Type         Spray Foam         Spray Foam           Insulation Trickness (rnm)         30         Private Units have Confort Cooling           Renewables         Type         None         Private Units have Confort Cooling           Cooling         EER         4.5         Controls           Summertime         Openable Windows         No         Mote           Openable Windows         No         Mote         Mote				
CHP - Heat to Power Ratio (·)         1.54         Heat Supplied / Power Supplied           Space Heating         Heat Distribution System         Pre-insulated low temperature, variable flow (1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Emitter         Underfloor (Screed)            Value         From Main System         Cylinder in Dwelling           Cylinder in Dwelling         No           Plate Heat Exchanger         Yes           Volume (Itres)         1           Insulation Type         Spray Foam           Insulation Thickness (nm)         30           Water Heating         Areas Cooled           Cooling         ERR           ERR         4.5           Controls         Valable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventiliation Required           Openable Windows         No				
Space Heating         Pre-insulated low temperature, variable flow (1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         District heating specification           Emitter         Underfloor (Screed)         Emitter           Variable Hoat Exchanger         Yes           Cylinder in Dwelling         No           Pate Heat Exchanger         Yes           Volume (litres)         1           Insulation Trype         Spray Foam           Insulation Trype         No           Vaste Water Heat Recovery         No           Renewables         Type           Cooling         Areas Cooled           EER         4.5           Controls         Variable Speed Compressor           Controls         Variable Speed Compressor           Summertime         Openable Windows           Openable Windows         No				
Apple Fraining         Heat Distribution System         temperature, variable flow (1991 or later)         District heating specification           Controls         Charging system linked to use, programmer and TRVs         Image: Controls         Charging system linked to use, programmer and TRVs           Emitter         Underfloor (Screed)         Image: Controls         Controls           Value         Type         From Main System         From Main System           Cylinder in Dwelling         No         Plate Heat Excharger         Yes           Value         Cylinder in Dwelling         No         Plate Heat Excharger         Yes           Value         Insulation Type         Spray Foam         Image: Spray Foam         Image: Spray Foam           Insulation Trickness (mm)         30         30         Private Units have Confort Cooling           Renewables         Type         None         Private Units have Confort Cooling           Cooling         EER         4.5         Controls         Valable Speed Compressor           Controls         Valable Speed Compressor         Openatie Windows         No           Summertime         Mechanical Ventiliation Required         Yes         No		CHP - Heat to Power Ratio (-)		Heat Supplied / Power Supplied
Controls         Charging system linked to use, programmer and TRVs           Emitter         Underfloor (Screed)           Type         From Main System           Cylinder in Dwelling         No           Cylinder in Dwelling         No           Plate Heat Exchanger         Yes           Volume (Itres)         1           Insulation Type         Spray Foam           Insulation Type         No           Vaste Water Heat Recovery         No           Vaste Water Heat Recovery         No           Renewables         Type           Cooling         Areas Cooled         All Lying Spaces and Bedrooms           After Active Windows         No           Controls         Variable Speed Compressor           Openable Windows         No           Summertime Overheating         Mechanical Ventiliation Required           Bitomet Time         Yes	Space Heating	Heat Distribution System	temperature, variable flow	District heating specification
Image: symmetrine cover base of the cover b				
Cylinder in Dwelling Plate Heat Exchanger         No           Water Heating         Plate Heat Exchanger         Yes           Volume (litres)         1           Insulation Type         Spray Foam           Insulation Thickness (nm)         30           Water Heat Recovery         No           Wate Water Heat Recovery         No           Renewables         Type           Cooling         EER           EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventiliation Required           No         No		Controls		
Plate Heat Exchanger         Yes           Water Heating         Nolume (litres)         1           Water Heating         Insulation Type         Spray Foam           Insulation Thickness (mm)         30           Insulation Thickness (mm)         30           Water Heating         Type           Water Heat Recovery         No           Renewables         Type           Areas Cooled         Bedrooms           Bedrooms         Atfordable Units have Comfort Cooling           EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required           Overheating         No			use, programmer and TRVs	
Plate Heat Exchanger         Yes           Water Heating         Volume (titres)         1           Water Heating         Insulation Type         Spray Foam           Insulation Thickness (mm)         30           Insulation Thickness (mm)         30           Water Heating         Type           Water Heat Recovery         No           Renewables         Type           Areas Cooled         Bedrooms           Bedrooms         Atfordable Units have Comfort Cooling           EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required           Overheating         No		Emitter	use, programmer and TRVs Underfloor (Screed)	
Volume (litres)         1           Water Heating         Insulation Type         Spray Foam           Insulation Type         Spray Foam           Insulation Thickness (mm)         30           Waste Water Heat Recovery         No           Renewables         Type           Areas Cooled         All Living Spaces and Bedrooms           Areas Cooled         All Living Spaces and Bedrooms           Cooling         EER           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required           Overheating         Elight-coloured curtain or		Emitter Type	use, programmer and TRVs Underfloor (Screed) From Main System	
Insulation Type         Spray Foam           Insulation Type         Spray Foam           Insulation Thickness (mm)         30           Waste Water Heat Recovery         No           Renewables         Type           Areas Cooled         All Living Spaces and Bedrooms         Private Units have Comfort Cooling           Cooling         EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required           Private Unitiation Required         Yes		Emitter Type Cylinder in Dwelling	use, programmer and TRVs Underfloor (Screed) From Main System	
Waste Water Heat Recovery         No           Renewables         Type         None           Areas Cooled         All Living Spaces and Bedrooms         Private Units have Comfort Cooling           Cooling         EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required         Yes           Overheating         Bit/orde         Light-coloured curtain or		Emitter Type Cylinder in Dwelling Plate Heat Exchanger	use, programmer and TRVs Underfloor (Screed) From Main System	
Renewables         Type         None           Renewables         Type         None           Areas Cooled         All Living Spaces and Bedrooms         Private Units have Comfort Cooling           EER         4.5         Affordable Units have no Comfort Cooling           Controls         Variable Speed Compressor         Affordable Units have no Comfort Cooling           Summertime         Openable Windows         No           Mechanical Ventilation Required         Yes           Overheating         Blitorie         Light-coloured curtain or	Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres)	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1	
Areas Cooled         All Living Spaces and Bedrooms         Private Units have Comfort Cooling Affordable Units have no Comfort Cooling           EER         4.5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventiliation Required           Overheating         Blioxiet           Blioxiet         Light-coloured curtain or	Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam	
Areas Looled         Bedrooms         Affordable Units have no Comfort Cooling           Cooling         EER         4,5           Controls         Variable Speed Compressor           Openable Windows         No           Summertime         Mechanical Ventilation Required         Yes           Overheating         Blicovie         Light-coloured curtain or	Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm)	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30	
EER         4,5           Controls         Variable Speed Compressor           Openable Windows         No           Mechanical Ventilation Required         Yes           Overheating         Blioxie         Light-coloured curtain or	-	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No	
Openable Windows         No           Summertime         Mechanical Ventilation Required         Yes           Overheating         Blinote         Light-coloured curtain or	Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Areas Cooled	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No None All Living Spaces and Bedrooms	
Summertime         Mechanical Ventilation Required         Yes           Overheating         Blinder         Light-coloured curtain or	Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Areas Cooled EER	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No None All Living Spaces and Bedrooms 4.5	
Overheating Blinde Light-coloured curtain or	Renewables	Emitter Type Cylinder in Dwelling Plat Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Areas Cooled EER Controls	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No None All Living Spaces and Bedrooms 4.5 Variable Speed Compressor	
	Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (ltres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Areas Cooled EER Controls Openable Windows	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No Noo All Living Spaces and Bedrooms 4.5 Variable Speed Compressor No	
	Renewables Cooling Summertime	Emitter Type Cylinder in Dwelling Plate Heat Eckhanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Areas Cooled EER Controls Openable Windows	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No No No No No All Living Spaces and Bedrooms 4,5 Variable Speed Compressor No Yes	

hoare lea (H.)

Project	Newcombe House - KCS2 (CLEAN)
Revision	2
Version	8
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
KCS2-A1	110.05	1	16.35	10.87	-33.54%	54.74	51.32	-6.25%	2.4	Medium
KCS2-A2	50.2	1	19.84	12.82	-35.37%	53.83	51.63	-4.07%	2.3	Medium
KCS2-A3	140.6	1	16.03	10.33	-35.60%	58.21	50.77	-12.78%	1.7	Medium
KCS2-A4	110.05	1	14.11	9.18	-34.94%	43.46	40.48	-6.86%	2.7	Medium
KCS2-A5	50.2	1	17.51	11.02	-37.06%	42.13	40.25	-4.46%	2.6	Medium
KCS2-A6	140.6	1	13.73	8.48	-38.24%	46.61	39.06	-16.21%	2.0	Medium
KCS2-A7	110.05	1	17.19	11.96	-30.45%	59.07	59.43	0.61%	2.5	Medium
KCS2-A8	50.2	1	19.84	13.50	-31.95%	53.83	55.86	3.78%	2.2	Medium
KCS2-A9	140.6	1	16.60	11.23	-32.36%	61.20	57.43	-6.16%	1.8	Medium
Area Weighted Results	902.55	9	16.21	10.66	-34.26%	53.37	49.60	-7.07%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
	Roof U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	, , , ,
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m <sup>2</sup> K)	0.18	
	To Stair Wells (W/m <sup>-</sup> K)	0.18	As Calculated by BS EN ISO 6946 Based on Construction of Walls, Floors, Roofs (including party and internal
Thermal Mass	Thermal Mass Parameter (Simple)	Low	floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges
			As stated on a test certificate from a person registered by an authorised
Air Permeability	Air Permeability Rate (m <sup>3</sup> /hm <sup>2</sup> at 50Pa)	3	pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure t If a dwelling is not pressure tested the value used in the calculation is an ar of the tested dwellings of the same type plus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. E Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join comport ogether
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	
	Boilers - Fraction of Heat (-)	0.3	As design specification
	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	Pre-insulated low temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
	Emitter	Underfloor (Screed)	
	Туре	From Main System	
	Cylinder in Dwelling	No	
	Plate Heat Exchanger	Yes	
	Volume (litres)	1	
Water Heating		Spray Foam	
Water Heating	Insulation Type	Spray i Gain	
Water Heating	Insulation Type Insulation Thickness (mm)	30	
Water Heating	Insulation Thickness (mm)	30	
	Insulation Thickness (mm) Waste Water Heat Recovery	30 No	
Water Heating Renewables	Insulation Thickness (mm) Waste Water Heat Recovery Type	30 No None	
	Insulation Thickness (mm) Waste Water Heat Recovery	30 No	

hoare lea (H.)

Project	Newcombe House - WPB1 (CLEAN)
Revision	2
Version	8
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
WPB1-A1	111.03	1	18.66	12.50	-33.02%	66.59	62.91	-5.52%	1.8	Medium
WPB1-A2	103.55	1	18.58	12.41	-33.24%	64.98	61.44	-5.45%	1.8	Medium
WPB1-A3	95.21	1	18.94	12.75	-32.68%	64.73	61.71	-4.67%	1.9	Medium
WPB1-A4	112.47	1	18.63	12.48	-33.02%	66.72	62.97	-5.62%	1.8	Medium
Area Weighted Results	422.26	4	18.70	12.53	-33.00%	65.81	62.29	-5.34%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m²K)	0.18	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m²K)	0.09	As Calculated by BS EN ISO 6946
External Fabric	Roof U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	(
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m²K)	0.18	As Calculated by BS EN ISO 6946
		0.10	Based on Construction of Walls, Floors, Roofs (including party and internal
Thermal Mass	Thermal Mass Parameter (Simple)	Low	floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges As stated on a test certificate from a person registered by an authorised pressure testing scheme
Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	Note to use the measured air perm rate each dwelling has to be pressure to If a dwelling is not pressure tested the value used in the calculation is an av- of the tested dwellings of the same type plus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. B Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join component together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	
	Boilers - Fraction of Heat (-)	0.3	As design specification
	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	Pre-insulated low temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
	Emitter	Underfloor (Screed)	
	Туре	From Main System	
	Cylinder in Dwelling	No	
	Plate Heat Exchanger	Yes	
	Volume (litres)	1	
Water Heating	Insulation Type	Spray Foam	
	Insulation Thickness (mm)	30	
	Waste Water Heat Recovery	No	
Renewables	Туре	None	
	Openable Windows	No	
Summertime	Mechanical Ventilation Required	Yes	
Overheating		Light-coloured curtain or	

### **DER Worksheet**

### Design - Draft



Assessor name Client Address 1. Overall dwelling dimen owest occupied otal floor area Dwelling volume 2. Ventilation rate Number of chimneys Number of open flues	(1a) ·	on	c) + (1d)(:		<b>rea (m²)</b> <u>164.79</u> 164.79	] (1a) x ] (4)	Ave h	erage storey eight (m) 2.85				] (3a)	External wall Party wall Total area of extern Fabric heat loss, W/ Heat capacity Cm = Thermal mass parar Thermal bridges: ∑( Total fabric heat los
Address 1. Overall dwelling dimen owest occupied otal floor area owelling volume 2. Ventilation rate Number of chimneys Number of open flues	sions (1a) -		c) + (1d)(:		164.79		Ave h	erage storey eight (m) 2.85		Vo	lume (m³)	] (3a)	Total area of extern Fabric heat loss, W/ Heat capacity Cm = Thermal mass parar Thermal bridges: <u>Σ</u> (
Overall dwelling dimen     owest occupied     otal floor area     owelling volume <b>2. Ventilation rate</b> Jumber of chimneys     Jumber of open flues	sions (1a) -		c) + (1d)(:		164.79		h	eight (m) 2.85	(2a) =			] (3a)	Heat capacity Cm = Thermal mass paraı Thermal bridges: Σ(
owest occupied fotal floor area Dwelling volume 2. Ventilation rate Number of chimneys Number of open flues	(1a) ·	+ (1b) + (1c	c) + (1d)(:		164.79		h	eight (m) 2.85	(2a) =			] (3a)	Thermal mass para Thermal bridges: ∑
otal floor area Dwelling volume 2. Ventilation rate Number of chimneys Number of open flues		+ (1b) + (1c	c) + (1d)(2		164.79		h	eight (m) 2.85	(2a) =			] (3a)	Thermal bridges: ∑
otal floor area Dwelling volume 2. Ventilation rate Number of chimneys Number of open flues		+ (1b) + (1d	c) + (1d)(2					2.85	) (2a) =		469.65	] (3a)	
otal floor area Dwelling volume 2. Ventilation rate Number of chimneys Number of open flues		+ (1b) + (1d	c) + (1d)(2				(3a		(2a) =		469.65	(3a)	Total fabric heat lo
Welling volume 2. Ventilation rate Number of chimneys Number of open flues		+ (1b) + (1d	c) + (1d)(1	1n) =	164.79	] (4)	(3a						
2. Ventilation rate Number of chimneys Number of open flues							(3a						
lumber of chimneys lumber of open flues								i) + (3b) + (3	c) + (3d)(3i	ר) = [	469.65	(5)	Ventilation heat lo
lumber of chimneys lumber of open flues													
Number of open flues										mi	<sup>3</sup> per hour		Heat transfer coeff
Number of open flues								0	x 40 =		0	(6a)	
								0	x 40 =		0	(6b)	Host loss para
lumber of intermittent fan	s							0	x 10 =		0	(7a)	Heat loss paramet
Number of passive vents	5							0	x 10 =		0	(7b)	
Number of flueless gas fires								0	x 40 =		0	(7C)	Number of days in
									. 10	Airo	hanges pe		
											hour		
nfiltration due to chimneys	s, flues, fans	, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	÷ (5) =		0.00	(8)	4. Water heating
f a pressurisation test has l	been carried	l out or is ir	ntended, pr	roceed to (.	17), otherw	ise continu	e from (9)	to (16)					Assumed occupan
Air permeability value, q50,	expressed i	in cubic me	etres per ho	our per squ	uare metre	of envelope	e area				3.00	(17)	Annual average ho
f based on air permeability	value, then	(18) = [(17	7) ÷ 20] + (8	8), otherwi	se (18) = (16	6)					0.15	(18)	
lumber of sides on which t	he dwelling	is sheltere	ed								1	(19)	Hot water usage in
helter factor								1 -	[0.075 x (19	)] =	0.93	(20)	
nfiltration rate incorporation	ng shelter fa	ictor							(18) x (20	) = 🗌	0.14	(21)	
nfiltration rate modified fo	r monthly w	vind speed:	:										Energy content of
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Aonthly average wind spee						1						7	
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)	Distribution loss 0
Vind factor (22)m ÷ 4				1	1	1	1	1			1	<b>-</b>	
1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)	Storage volume (li
djusted infiltration rate (a						1	1	1				7	Water storage loss
0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	(22b)	b) Manufacturer's
Calculate effective air chan											0.50	] (22-)	Hot water stor
If mechanical ventilation	0		0,								0.50	(23a)	Volume factor
If balanced with heat rea a) If balanced mechanica							a) • 1001				79.90	(23c)	Temperature fa
			1				1	0.24	0.25	0.26	0.26	(240)	Energy lost from
0.28 ffective air change rate - e	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(24a)	Enter (50) or (54) i Water storage loss
	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(25)	water storage los
0.28	0.27	0.27	0.25	0.25	0.25	0.25	0.23	0.24	0.25	0.20	0.20	_ (23)	
											N: CB-A1 v sessor vers		

Element			er										
			;	Gross area, m <sup>2</sup>	Openings m <sup>2</sup>		area m²	U-value W/m²K	A x U W		/alue, /m².K	Ахк, kJ/K	
Window						43	.25 x	1.05	= 45.57				(27)
Ground floor						164	l.79 x	0.09	= 14.83				(28
External wall						95	.46 x	0.25	= 23.87				(29
External wall						30	.12 x	0.18	= 5.42				(29
Party wall						9.	58 x	0.00	= 0.00				(32
Total area of ex	xternal eleme	ents ∑A, m²	2			333	8.62						(31
Fabric heat loss	s, W/K = ∑(A	× U)							(26	i)(30) + (3	32) =	89.69	(33
Heat capacity C	Cm = ∑(А x к)							(28)	.(30) + (32) +	- (32a)(32	2e) =	N/A	(34
Thermal mass p	parameter (T	MP) in kJ/n	n²K									100.00	(35
Thermal bridge	es: ∑(L x Ψ) ca	alculated us	sing Apper	ndix K								50.04	(36
Total fabric hea	at loss									(33) + (3	36) =	139.73	_   (37
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	_
Ventilation hea	at loss calcula	ted month	ly 0.33 x (	25)m x (5)									
	42.99	42.46	41.92	39.23	38.69	36.00	36.00	35.47	37.08	38.69	39.77	40.84	(38
Heat transfer c				•									_
	182.72	182.19	181.65	178.96	178.42	175.74	175.74	175.20	176.81	178.42	179.50	180.57	٦
								· · · · ·	Average = $\Sigma$	-	·	178.83	] (39
Heat loss paran	meter (HLP).	W/m²K (39	9)m ÷ (4)						201010-00	(,			
	1.11	1.11	1.10	1.09	1.08	1.07	1.07	1.06	1.07	1.08	1.09	1.10	٦
			1.10	1.05	1.00	1.07	1.07				·	1.09	」 ](40
Average = $\Sigma(40)112/12 = 1.09$ (* Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40
	51.00	20.00	51.00	50.00	51.00	50.00	51.00	51.00	50.00	51.00	30.00	51.00	] (40)
4. Water heat	ting energy r	eauiremen	+										
Assumed occup	pancy, N											2.96	(42)
				Vd,average	= (25 x N) +	· 36						2.96 104.39	7
				Vd,average <b>Apr</b>	= (25 x N) + <b>May</b>	· 36 Jun	lut	Aug	Sep	Oct	Nov		
Annual average	e hot water u Jan	isage in litre <b>Feb</b>	es per day <b>Mar</b>	Apr	May	Jun		Aug	Sep	Oct	Nov	104.39	] (42) ] (43)
Annual average	e hot water u Jan	isage in litre <b>Feb</b>	es per day <b>Mar</b>	Apr	May	Jun		<b>Aug</b> 98.13	Sep	<b>Oct</b> 106.48	Nov	104.39	
Annual average	e hot water u Jan ge in litres pe	isage in litre <b>Feb</b> r day for ea	es per day <b>Mar</b> ach month	<b>Apr</b> Vd,m = fac	May tor from Tab	Jun ble 1c x (43	)				110.66	104.39 Dec	
Annual average	e hot water u Jan ge in litres pe 114.83	Isage in litro <b>Feb</b> In day for ea 110.66	es per day <b>Mar</b> ach month 106.48	Apr Vd,m = fac 102.31	May tor from Tab 98.13	Jun ble 1c x (43 93.95	) 93.95	98.13		106.48	110.66	104.39 Dec 114.83	] (43)
Assumed occup Annual average Hot water usag Energy content	e hot water u Jan ge in litres pe 114.83	Isage in litro <b>Feb</b> In day for ea 110.66	es per day Mar ach month 106.48	Apr Vd,m = fact 102.31 x nm x Tm/3	May tor from Tat 98.13 3600 kWh/n	Jun ble 1c x (43 93.95 nonth (see	) 93.95 Tables 1b,	98.13	102.31	106.48 ∑(44)1	110.66	104.39 Dec 114.83 1252.73	] (43)
Annual average	a hot water u Jan ge in litres pe 114.83 t of hot wate	r day for ea r day for ea 110.66 r used = 4.1	es per day <b>Mar</b> ach month 106.48	Apr Vd,m = fac 102.31	May tor from Tab 98.13	Jun ble 1c x (43 93.95	) 93.95	98.13 1c 1d)		106.48 ∑(44)1 139.13	110.66 12 = 151.87	104.39 Dec 114.83 1252.73 164.92	] (43) ] (44) ] (44)
Annual average Hot water usag Energy content	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29	r day for ea 110.66 r used = 4.1 148.94	es per day Mar ach month 106.48	Apr Vd,m = fact 102.31 x nm x Tm/3	May tor from Tat 98.13 3600 kWh/n	Jun ble 1c x (43 93.95 nonth (see	) 93.95 Tables 1b,	98.13 1c 1d)	102.31	106.48 ∑(44)1	110.66 12 = 151.87	104.39 Dec 114.83 1252.73	] (43)
Annual average Hot water usag Energy content	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29	r day for ea 110.66 r used = 4.1 148.94	es per day Mar ach month 106.48 18 x Vd,m 153.69	Apr Vd,m = fact 102.31 x nm x Tm/3 133.99	May tor from Tat 98.13 3600 kWh/n	Jun ble 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 114.83 1252.73 164.92	] (43 ] (44 ] (45
Annual average Hot water usag Energy content Distribution los	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54	r day for ea 110.66 r used = 4.1 148.94 m 22.34	es per day <b>Mar</b> ach month 106.48 18 x Vd,m 153.69 23.05	Apr Vd,m = fact 102.31 x nm x Tm/3 133.99 20.10	May tor from Tab 98.13 3600 kWh/m 128.57 19.29	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b,	98.13 1c 1d)	102.31	106.48 ∑(44)1 139.13	110.66 12 = 151.87	104.39 Dec 114.83 1252.73 164.92 1642.52 24.74	] (43 ] (44 ] (45 ] (45
Annual average Hot water usag Energy content Distribution los Storage volume	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu	r day for ea 110.66 r used = 4.1 148.94 m 22.34	es per day <b>Mar</b> ach month 106.48 18 x Vd,m 153.69 23.05	Apr Vd,m = fact 102.31 x nm x Tm/3 133.99 20.10	May tor from Tab 98.13 3600 kWh/m 128.57 19.29	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 114.83 1252.73 1642.52	] (43 ] (44 ] (45 ] (45
Annual average Hot water usag Energy content Distribution los Storage volume Water storage	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss:	rsage in litre           Feb           r day for ea           110.66           r used = 4.1           148.94           m           22.34           uding any so	es per day Mar ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storag	May tor from Tab 98.13 3600 kWh/m 128.57 19.29	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 114.83 1252.73 164.92 1642.52 24.74	] (43 ] (44 ] (45 ] (45
Annual average Hot water usag Energy content Distribution los Storage volume Nater storage o) Manufacture	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 cs 0.15 x (45) 25.54 e (litres) inclu loss: er's declared	r day for ea 110.66 r used = 4.1 148.94 m 22.34 Juding any so loss factor	es per day <b>Mar</b> ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storage wn	May tor from Tat 98.13 3600 kWh/m 128.57 19.29 ge within sat	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 Σ(44)1 139.13 Σ(45)1	110.66 12 = 151.87 12 =	104.39           Dec           114.83           1252.73           164.92           1642.52           24.74           1.00	] (43 ] (44 ] (44 ] (45 ] (45 ] (46 ] (47
Annual average Hot water usag Energy content Distribution los Storage volume Water storage o) Manufacture Hot water st	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fa	Instant         Instant           r day for ea         110.66           r used = 4.1         148.94           Imm         22.34           Juding any so         Joss factor           loss factor from Tactor from Tactor         Instant	es per day <b>Mar</b> ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storage wn	May tor from Tat 98.13 3600 kWh/m 128.57 19.29 ge within sat	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 Σ(44)1 139.13 Σ(45)1	110.66 12 = 151.87 12 =	104.39 Dec 114.83 1252.73 164.92 1642.52 24.74 1.00 0.02	) (43 ) (44 ) (44 ) (45 ) (45 ) (46 ) (47
Annual average Hot water usag Energy content Distribution los Storage volume Water storage b) Manufacture Hot water si Volume fact	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fator from Table	r day for ea         110.66         r used = 4.1         148.94         )m         22.34         uding any so         loss factor         actor from 1         e2a	es per day <b>Mar</b> ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storage wn	May tor from Tat 98.13 3600 kWh/m 128.57 19.29 ge within sat	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 Σ(44)1 139.13 Σ(45)1	110.66 12 = 151.87 12 =	104.39 Dec 1114.83 1252.73 164.92 1642.52 24.74 1.00 0.02 4.93	) (43 ) (44 ) (44 ) (45 ) (46 ) (47 ) (47 ) (51 ) (52
Annual average Hot water usag Energy content Distribution los Storage volume Water storage l b) Manufacture Hot water si Volume fact Temperatur	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fa tor from Tabl	r day for ea         110.66         r used = 4.1         148.94         )m         22.34         uding any so         loss factor         actor from         le 2a         n Table 2b	es per day Mar ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno Table 2 (kt	Apr Vd,m = fac: 102.31 x nm x Tm/3 133.99 20.10 VHRS storag wn Nh/litre/da	May tor from Tat 98.13 3600 kWh/n 128.57 19.29 te within sar y)	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 Σ(44)1 139.13 Σ(45)1	110.66 12 = 151.87 12 =	104.39 Dec 1114.83 1252.73 164.92 1642.52 24.74 1.00 0.02 4.93 1.00	(43 ) (44 ) (44 ) (45 ) (45 ) (45 ) (45 ) (45 ) (45 ) (51 ) (51 ) (52 ) (53
Annual average Hot water usag Energy content Distribution los Storage volume Water storage i b) Manufacture Hot water st Volume fact Temperatur Energy lost	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fa tor from Tabl re factor from from water s	r day for ea         110.66         r used = 4.1         148.94         )m         22.34         uding any so         loss factor         actor from         le 2a         n Table 2b	es per day Mar ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno Table 2 (kt	Apr Vd,m = fac: 102.31 x nm x Tm/3 133.99 20.10 VHRS storag wn Nh/litre/da	May tor from Tat 98.13 3600 kWh/n 128.57 19.29 te within sar y)	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 1114.83 1252.73 1664.92 1642.52 24.74 1.00 0.02 4.93 1.00 0.10	(43) (44) (44) (45) (45) (45) (47) (51) (52) (53) (53) (54)
Annual average Hot water usag Energy content Distribution los Storage volume Water storage i b) Manufacture Hot water st Volume fact Temperatur Energy lost i Enter (50) or (5	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fa tor from Tabl re factor from from water s 64) in (55)	r day for ea 110.66 r used = 4.1 148.94 )m 22.34 uding any so loss factor actor from le 2a n Table 2b storage (kW	es per day Mar ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno Table 2 (k' /h/day) (4	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storag wn Wh/litre/da	May tor from Tat 98.13 3600 kWh/n 128.57 19.29 te within sar y)	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 1114.83 1252.73 164.92 1642.52 24.74 1.00 0.02 4.93 1.00	) (43 ) (44 ) (45 ) (45 ) (46 ) (47 ) (51 ) (51 ) (52 ) (53 ) (54
Annual average Hot water usag Energy content Distribution los Storage volume Water storage i b) Manufacture Hot water st Volume fact Temperatur Energy lost	e hot water u Jan ge in litres pe 114.83 t of hot wate 170.29 ss 0.15 x (45) 25.54 e (litres) inclu loss: er's declared torage loss fa tor from Tabl re factor from from water s 64) in (55)	r day for ea 110.66 r used = 4.1 148.94 )m 22.34 uding any so loss factor actor from le 2a n Table 2b storage (kW	es per day Mar ach month 106.48 18 x Vd,m 153.69 23.05 olar or WV is not kno Table 2 (k' /h/day) (4	Apr Vd,m = fac 102.31 x nm x Tm/3 133.99 20.10 VHRS storag wn Wh/litre/da	May tor from Tat 98.13 3600 kWh/n 128.57 19.29 te within sar y)	Jun ole 1c x (43 93.95 nonth (see 110.95	) 93.95 Tables 1b, 102.81	98.13 1c 1d) 117.97	102.31	106.48 <u>Σ</u> (44)1 139.13 <u>Σ</u> (45)1	110.66 12 = 151.87 12 =	104.39 Dec 1114.83 1252.73 1664.92 1642.52 24.74 1.00 0.02 4.93 1.00 0.10	) (43 ) (44 ) (45 ) (45 ) (46 ) (47 ) (51 ) (51 ) (52 ) (53

Page 2

URN: CB-A1 version 15 NHER Plan Assessor version 6.3.4 SAP version 9.92

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] $\div$ (47), else (56)	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Primary circuit loss for each month from Table 3	Utilisation factor for gains for living area n1,m (see Table 9a)
23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26 22.51 23.26 (59)	0.97 0.95 0.90 0.81 0.69 0.54 0.41 0.46 0.67 0.87 0.95 0.98 (86)
Combi loss for each month from Table 3a, 3b or 3c	Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)
	18.61         19.00         19.52         20.12         20.57         20.85         20.95         20.72         20.08         19.23         18.55         (87)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
196.79       172.88       180.19       159.64       155.07       136.59       129.31       144.47       145.03       165.63       177.52       191.42       (62)	<u>19.99</u> 20.00 20.00 20.01 20.01 20.03 20.03 20.03 20.02 20.01 20.01 20.00 (88)
Solar DHW input calculated using Appendix G or Appendix H	Utilisation factor for gains for rest of dwelling n2,m
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)	0.97 0.94 0.88 0.79 0.65 0.48 0.33 0.38 0.61 0.84 0.95 0.97 (89)
Output from water heater for each month (kWh/month) (62)m + (63)m	Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)
196.79         172.88         180.19         159.64         155.07         136.59         129.31         144.47         145.03         165.63         177.52         191.42	16.79         17.35         18.10         18.94         19.54         19.89         19.99         19.98         19.74         18.90         17.69         16.70         (90)
$\Sigma$ (64)112 = 1954.54 (64)	Living area fraction Living area ÷ (4) = 0.52 (91)
Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]	Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2
77.82 68.67 72.30 65.07 63.95 57.41 55.38 60.43 60.21 67.46 71.01 76.04 (65)	17.73 18.20 18.83 19.55 20.07 20.38 20.48 20.47 20.25 19.51 18.48 17.65 (92)
	Apply adjustment to the mean internal temperature from Table 4e where appropriate
5. Internal gains	17.73 18.20 18.83 19.55 20.07 20.38 20.48 20.47 20.25 19.51 18.48 17.65 (93)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Metabolic gains (Table 5)	8. Space heating requirement
147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 (66)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	Utilisation factor for gains, ηm
29.97 26.62 21.65 16.39 12.25 10.34 11.18 14.53 19.50 24.76 28.90 30.81 (67)	0.95 0.92 0.86 0.77 0.65 0.50 0.37 0.41 0.62 0.83 0.93 0.96 (94)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	Useful gains, nmGm, W (94)m x (84)m
336.20 339.69 330.89 312.18 288.55 266.35 251.52 248.03 256.82 275.53 299.16 321.36 (68)	864.90 1085.31 1244.65 1305.22 1199.41 914.16 649.87 668.22 897.92 978.85 872.35 802.63 (95)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	Monthly average external temperature from Table U1
37.78 37.78 37.78 37.78 37.78 37.78 37.78 37.78 (69)	4.30         4.90         6.50         8.90         11.70         14.60         16.60         16.40         14.10         10.60         7.10         4.20         (96)
Pump and fan gains (Table 5a)	Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	2453.60 2422.80 2240.29 1905.95 1494.28 1016.32 682.55 712.76 1086.51 1589.86 2043.28 2429.30 (97)
Losses e.g. evaporation (Table 5)	Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m
-118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 -118.22 (71)	1182.00         898.80         740.76         432.53         219.38         0.00         0.00         0.00         454.59         843.07         1210.24
Water heating gains (Table 5)	$\sum(98)15, 1012 = 5981.35 $ (98)
104.60         102.19         97.18         90.37         85.95         79.73         74.44         81.22         83.63         90.67         98.63         102.20         (72)	Space heating requirement kWh/m <sup>2</sup> /year (98) $\div$ (4) 36.30 (99)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	8c. Space cooling requirement
538.10       535.83       517.06       486.28       454.09       423.76       404.47       411.11       427.28       458.30       494.02       521.70       (73)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
6. Solar gains	Heat loss rate Lm
Access factor Area Solar flux g FF Gains	
Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W	
or Table 6b or Table 6c	Utilisation factor for loss nm
North 0.77 x 9.09 x 10.63 x 0.9 x 0.55 x 0.80 = 29.47 (74)	
East 0.77 x 15.15 x 19.64 x 0.9 x 0.55 x 0.80 = 90.73 (76)	Useful loss nmLm (watts) (100)m x (101)m
South 0.77 x 16.18 x 46.75 x 0.9 x 0.55 x 0.80 = 230.66 (78)	0.00 0.00 0.00 0.00 0.00 1377.96 1149.02 1145.93 0.00 0.00 0.00 0.00 (102)
West 0.77 x 2.83 x 19.64 x 0.9 x 0.55 x 0.80 = 16.95 (80)	Gains
Solar gains in watts $\Sigma(74)$ m(82)m	0.00 0.00 0.00 0.00 0.00 2256.40 2163.65 2006.03 0.00 0.00 0.00 0.00 (103)
367.81 644.72 923.79 1203.51 1393.85 1401.80 1344.14 1200.78 1021.19 724.43 444.03 312.43 (83)	Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m
Total gains - internal and solar (73)m + (83)m	0.00 0.00 0.00 0.00 0.00 632.48 754.88 639.92 0.00 0.00 0.00 0.00
905.91 1180.55 1440.85 1689.78 1847.94 1825.56 1748.60 1611.89 1448.46 1182.73 938.04 834.13 (84)	Σ(104)68 = 2027.28 (104)
(84) 834.15 1100.00 11040.00 1007.00 1004.24 102.20 1740.00 1011.03 1440.40 1102.73 300.04 834.15	Cooled fraction cooled area ÷ (4) = 0.82 (105)
7. Mean internal temperature (heating season)	Intermittency factor (Table 10)
URN: CB-A1 version 15	URN: CB-A1 version 15
NHER Plan Assessor version 6.3.4 Page 3 SAP version 9.92	NHER Plan Assessor version 6.3.4 Page 4 SAP version 9.92
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	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	]
										∑(106)6	8 =	0.75	(106)
Space cooling requirement (104)m x (105) x (106)m													
	0.00	0.00	0.00	0.00	0.00	129.77	154.88	131.29	0.00	0.00	0.00	0.00	]
										∑(107)6	8 =	415.94	(107)
Space cooling re	equirement	kWh/m²/ye	ear							(107) ÷	(4) =	2.52	(108)
9b. Energy req	uirements ·	communit	y heating s	cheme									
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 11	.)				'0' if ı	none 🗌	0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity hea	t from boile	ers									0.30	(303a

Fraction of community heat from CHP

Annual space heating requirement

Space heating

Water heating

Space heat from CHP

Space heat from boilers

Fraction of total space heat from community CHP

Fraction of total space heat from community boilers

Factor for control and charging method (Table 4c(3)) for community space heating

Factor for charging method (Table 4c(3)) for community water heating

Distribution loss factor (Table 12c) for community heating system

11b. SAP rating - community neating scheme		
Energy cost deflator (Table 12)	0.42	(356)
Energy cost factor (ECF)	1.06	(357)
SAP value	85.25	]
SAP rating (section 13)	85	(358)
SAP band	В	]

12b. CO <sub>2</sub> emissions - community heating scheme										
		Energy kWh/year		Emission factor						
Emissions from community CHP (space a	nd water heating)									
Power efficiency of CHP unit		31.50								
Heat efficiency of CHP unit		48.50								
Space heating from CHP	(307a) × 100 ÷ (362) =	9063.7862	х	0.2160						

,						
Water heated by CHP	2961.8001	x	0.2160	=	639.7488	(365)
less credit emissions for electricity	-932.8504	x	0.5190	=	-484.1494	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	91.80					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	2723.10	x	0.216	=	588.19	(368)
Electrical energy for community heat distribution	83.33	x	0.519	=	43.25	(372)
Total CO2 associated with community systems					1263.21	(373)
Total CO2 associated with space and water heating					1263.21	(376)
Space cooling	68.47	x	0.519	=	35.53	(377)
Pumps and fans	379.60	x	0.519	=	197.01	(378)
Electricity for lighting	529.32	x	0.519	=	274.72	(379)
Total CO <sub>2</sub> , kg/year				(376)(382) =	1770.47	(383)
Dwelling CO <sub>2</sub> emission rate				(383) ÷ (4) =	10.74	(384)
El value					88.69	]
El rating (section 14)					89	(385)
El band					В	]

-2854.7358

#### 13b. Primary energy - community heating scheme

less credit emissions for electricity

		Energy kWh/year		Primary factor		Primary energy (kWh/year)	/
Primary Energy from communi	ty CHP (space and water heating)						
Power efficiency of CHP unit		31.50	]				(361)
Heat efficiency of CHP unit		48.50	]				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	9063.79	] x	1.22	=	11057.82	(363)
less credit energy for electr	icity	-2854.74	] x	3.07	=	-8764.04	(364)
Water heated by CHP		2961.80	] x	1.22	=	3613.40	(365)
less credit energy for electricity	/	-932.85	] x	3.07	=	-2863.85	(366)
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		91.80	]				(367b)
Primary energy from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	2723.10	] x	1.22	=	3322.18	(368)
Electrical energy for communit	y heat distribution	83.33	x	3.07	=	255.81	(372)
Total primary energy associate	d with community systems					6621.32	(373)
Total primary energy associate	d with space and water heating					6621.32	(376)
Space cooling		68.47	] x	3.07	=	210.19	(377)

URN: CB-A1 version 15

Emissions (kg/year)

1957.7778

-1481.6079 (364)

=

=

0.5190

(361)

(362)

(363)

NHER Plan Assessor version 6.3.4 SAP version 9.92

Annual water heating requirement	1954.54	(64)
Water heat from CHP	(64) x (303a) x (305a) x (306) = 1436.59	(310a)
Water heat from boilers	(64) x (303b) x (305a) x (306) = 615.68	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] = 83.33	(313)
Cooling System Energy Efficiency Ratio	6.08	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	(107) ÷ (314) 68.47	(315)
Electricity for pumps, fans and electric keep-hot (Table 4f)		
mechanical ventilation fans - balanced, extract or positive input from outside	379.60	(330a)

5981.35

(98) x (304a) x (305) x (306) =

(98) x (304b) x (305) x (306) =

mechanical ventilation fans - balanced, extract or positive input fr	om outside	379.60		(330a)
Total electricity for the above, kWh/year			379.60	(331)
Electricity for lighting (Appendix L)			529.32	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312)	+ (315) + (331) + (332)(337b) =	9310.07	(338)

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from CHP	4396.29	х	2.97	x 0.01 =	130.57	(340a)
Space heating from boilers	1884.13	х	4.24	x 0.01 =	79.89	(340b)
Water heating from CHP	1436.59	х	2.97	x 0.01 =	42.67	(342a)
Water heating from boilers	615.68	х	4.24	x 0.01 =	26.10	(342b)
Space cooling	68.47	х	13.19	x 0.01 =	9.03	(348)
Pumps and fans	379.60	х	13.19	x 0.01 =	50.07	(349)
Electricity for lighting	529.32	х	13.19	x 0.01 =	69.82	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) ·	+ (345)(354) =	528.15	(355)

URN: CB-A1 version 15

NHER Plan Assessor version 6.3.4

0.70

0.70

0.30

1.00

1.00

1.05

4396.29

1884.13

(302) x (303a) =

(302) x (303b) =

(303b)

(304a)

(304b)

(305)

(305a)

(306)

(98)

(307a)

(307b)

SAP version 9.92

Pumps and fans	379.60	х	3.07	=	1165.36	(378)
Electricity for lighting	529.32	х	3.07	=	1625.01	(379)
Primary energy kWh/year					9621.89	(383)
Dwelling primary energy rate kWh/m2/year					58.39	(384)

### **DER Worksheet**



Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address	A1, London		

#### 1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)	Volume (m³)
Lowest occupied	[	175.68	(1a) >	ĸ	2.70 (2a) =	474.34 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) = [	175.68	(4)			
Dwelling volume					(3a) + (3b) + (3c) + (3d)(3	n) = 474.34 (5)

#### 2. Ventilation rate

											m	<sup>3</sup> per hour	
Number of chim	neys								0	x 40 =	-	0	(6a)
Number of open	flues								0	] x 20 =	-	0	(6b)
Number of inter	mittent far	IS							0	) x 10 =	-	0	(7a)
Number of passi	ve vents								0	] x 10 =	-	0	(7b)
Number of fluel	ess gas fire	5							0	] x 40 =	-	0	(7c)
											Air	changes pe hour	r
Infiltration due t	o chimney	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	] ÷ (5) =	-	0.00	(8)
lf a pressurisatio	n test has l	been carried	d out or is i	ntended, pr	roceed to (1	17), otherw	ise continue	e from (9) t	o (16)				
Air permeability	value, q50	, expressed	in cubic m	etres per h	our per squ	are metre	of envelope	e area				3.00	(17)
If based on air p	ermeability	value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwis	se (18) = (16	5)					0.15	(18)
Number of sides	on which t	the dwelling	; is sheltere	ed								1	(19)
Shelter factor									1 -	[0.075 x (1	9)] =	0.93	(20)
Infiltration rate i	ncorporati	ng shelter f	actor							(18) x (2	20) =	0.14	(21)
Infiltration rate r	modified fo	or monthly v	vind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	Jan e wind spee	Feb	Mar		May	Jun	lul	Aug	Sep	Oct	Nov	Dec	_
, ,	Jan e wind spee 5.10	Feb	Mar		<b>May</b> 4.30	Jun 3.80	Jul 3.80	Aug 3.70	Sep 4.00	Oct 4.30	<b>Nov</b>	<b>Dec</b>	(22)
Monthly average Wind factor (22)	Jan e wind spee 5.10 m ÷ 4	Feb ed from Tab	Mar le U2 4.90	<b>Apr</b> 4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	
Wind factor (22)	Jan e wind spee 5.10 m ÷ 4 1.28	Feb ed from Tab 5.00 1.25	Mar le U2 4.90 1.23	Apr 4.40 1.10	4.30	3.80 0.95							] (22) ] (22a)
, ,	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a	Feb ed from Tab 5.00 1.25 Ilowing for	Mar le U2 4.90 1.23 shelter and	Apr 4.40 1.10 d wind factor	4.30 1.08 pr) (21) x (2	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	4.30	4.50	4.70	] (22a)
Wind factor (22) Adjusted infiltra	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18	Feb           ed from Tab           5.00           1.25           llowing for           0.17	Mar le U2 4.90 1.23 shelter and 0.17	Apr 4.40 1.10 wind facto 0.15	4.30	3.80 0.95	3.80	3.70	4.00	4.30	4.50	4.70	
Wind factor (22) Adjusted infiltrat	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan	Feb ed from Tab 5.00 1.25 Illowing for 0.17 ge rate for	Mar le U2 4.90 1.23 shelter and 0.17 the applica	Apr 4.40 1.10 wind facto 0.15 ble case:	4.30 1.08 pr) (21) x (2 0.15	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	4.30	4.50	4.70 1.18 0.16	] (22a) ] (22b)
Wind factor (22) Adjusted infiltra Calculate effecti If mechanical	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan I ventilation	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for the the change	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throu	Apr 4.40 1.10 d wind factor 0.15 ble case: ugh system	4.30 1.08 pr) (21) x (2 0.15	3.80 0.95 2a)m 0.13	3.80 0.95 0.13	3.70 0.93	4.00	4.30	4.50	4.70	] (22a) ] (22b) ] (23a)
Wind factor (22) Adjusted infiltra Calculate effecti If mechanical If balanced w	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan l ventilation vith heat re	Feb ed from Table 5.00 1.25 Ilowing for 0.17 ge rate for 1 n: air chang covery: effi	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throi ciency in %	Apr 4.40 1.10 I wind factor 0.15 ble case: ugh system allowing fo	4.30 1.08 pr) (21) x (2 0.15	3.80 0.95 2a)m 0.13	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16	] (22a) ] (22b)
Wind factor (22) Adjusted infiltra Calculate effecti If mechanical	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan l ventilation rith heat re d mechanic	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for 1 n: air chang covery: effi al ventilatic	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throi ciency in % n with hea	Apr 4.40 1.10 I wind factt 0.15 ble case: ugh system allowing fo t recovery	4.30 1.08 or) (21) x (2 0.15 or in-use fac (MVHR) (22	3.80 0.95 2a)m 0.13 ctor from T. 2b)m + (23b	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16 79.90	] (22a) ] (22b) ] (22b) ] (23a) ] (23c)
Wind factor (22) Adjusted infiltra Calculate effecti If mechanical If balanced w a) If balanced	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan l ventilation rith heat re d mechanic 0.28	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for the air chang covery: effi al ventilatic 0.27	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throw ciency in % n with hea 0.27	Apr 4.40 1.10 I wind facto 0.15 ble case: ugh system allowing fo t recovery 0.25	4.30 1.08 pr) (21) x (2 0.15 pr in-use fac (MVHR) (22 0.25	3.80 0.95 2a)m 0.13	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16	] (22a) ] (22b) ] (23a)
Wind factor (22) Adjusted infiltra Calculate effecti If mechanical If balanced w	Jan e wind spee 5.10 m ÷ 4 1.28 tion rate (a 0.18 ve air chan l ventilation rith heat re d mechanic 0.28	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for the air chang covery: effi al ventilatic 0.27	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throw ciency in % n with hea 0.27	Apr 4.40 1.10 I wind facto 0.15 ble case: ugh system allowing fo t recovery 0.25	4.30 1.08 pr) (21) x (2 0.15 pr in-use fac (MVHR) (22 0.25	3.80 0.95 2a)m 0.13 ctor from T. 2b)m + (23b	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16 79.90	] (22a) ] (22b) ] (22b) ] (23a) ] (23c)

Page 1



3. Heat losses and heat loss parameter	Primary circuit loss for each month from Table 3
Element Gross Openings Net area U-value А x U W/К к-value, А x к,	23.26         21.01         23.26         22.51         23.26         22.51         23.26         23.26         22.51         23.26         23.26         22.51         23.26         23.26         22.51         23.26 <th< td=""></th<>
area, m <sup>2</sup> m <sup>2</sup> A, m <sup>2</sup> W/m <sup>2</sup> K kJ/m <sup>2</sup> .K kJ/K	Combi loss for each month from Table 3a, 3b or 3c
Window $50.94$ x $1.05$ = $53.67$ (27)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)
Ground floor 175.65 x 0.09 = 15.81 (28a)	Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m
External wall         126.94         x         0.18         =         22.85         (29a)	197.36         173.37         180.70         160.08         155.50         136.96         129.65         144.87         145.42         166.09         178.02         191.97         (62)
Total area of external elements $\Sigma A$ , m <sup>2</sup> 353.53 (31)	Solar DHW input calculated using Appendix G or Appendix H
Fabric heat loss, $W/K = \sum (A \times U)$ (26)(30) + (32) = 92.33 (33)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)
Heat capacity $Cm = \sum (A \times \kappa)$ (28)(30) + (32) + (32a)(32e) = N/A (34)	Output from water heater for each month (kWh/month) (62)m + (63)m
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K [100.00] (35)	197.36         173.37         180.70         160.08         155.50         136.96         129.65         144.87         145.42         166.09         178.02         191.97
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Appendix K 53.03 (36)	Σ(64)112 = <u>1960.00</u> (64)
Total fabric heat loss (33) + (36) = 145.36 (37)	Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	78.01 68.84 72.47 65.22 64.09 57.53 55.50 60.56 60.34 67.61 71.18 76.22 (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	
43.42         42.88         42.34         39.62         39.08         36.36         36.36         35.82         37.45         39.08         40.16         41.25         (38)	5. Internal gains
Heat transfer coefficient, W/K (37)m + (38)m	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
188.78         188.24         187.70         184.98         184.44         181.72         181.72         181.18         182.81         184.44         185.52         186.61	Metabolic gains (Table 5)
Average = $\Sigma(39)112/12 = 184.85$ (39)	148.51       148.51
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
1.07         1.07         1.07         1.05         1.03         1.03         1.03         1.04         1.05         1.06         1.06	30.96         27.50         22.36         16.93         12.66         10.69         11.55         15.01         20.14         25.58         29.85         31.82         (67)
Average = $\Sigma(40)112/12 = 1.05$ (40)	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
Number of days in month (Table 1a)	347.30         350.90         341.82         322.49         298.08         275.14         259.82         256.22         265.30         284.63         309.04         331.98         (68)
31.00 28.00 31.00 30.00 31.00 30.00 31.00 31.00 31.00 30.00 31.00 30.00 31.00 (40)	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
	37.85         37.85
4. Water heating energy requirement	Pump and fan gains (Table 5a)
Assumed occupancy, N 2.97 (42)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)
Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 [104.74] (43)	Losses e.g. evaporation (Table 5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	-118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 (71)
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	Water heating gains (Table 5)
115.21         111.02         106.84         102.65         98.46         94.27         94.27         98.46         102.65         106.84         111.02         115.21	104.85         102.43         97.41         90.58         86.14         79.90         74.59         81.39         83.81         90.88         98.86         102.44         (72)
$\Sigma(44)112 = 1256.89$ (44)	Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	550.67 548.39 529.15 497.55 464.44 433.28 413.51 420.17 436.80 468.64 505.30 533.79 (73)
170.86 149.44 154.20 134.44 129.00 111.31 103.15 118.37 119.78 139.59 152.37 165.47	C. Colonaria
$\Sigma(45)112 = 1647.98$ (45)	6. Solar gains
Distribution loss 0.15 x (45)m	Access factor Area Solar flux g FF Gains Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W
25.63         22.42         23.13         20.17         19.35         16.70         15.47         17.75         17.97         20.94         22.86         24.82         (46)	or Table 6b or Table 6c
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00 (47)	East 0.77 x 20.62 x 19.64 x 0.9 x 0.55 x 0.80 = 123.49 (76)
Water storage loss:	South 0.77 x 11.45 x 46.75 x 0.9 x 0.55 x 0.80 = 163.23 (78)
b) Manufacturer's declared loss factor is not known	West 0.77 x 18.87 x 19.64 x 0.9 x 0.55 x 0.80 = 113.01 (80)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)	Solar gains in watts ∑(74)m(82)m
Volume factor from Table 2a 4.93 (52)	399.72 729.96 1102.41 1496.04 1762.84 1779.99 1704.28 1506.24 1241.83 837.29 488.36 335.52 (83)
Temperature factor from Table 2b 1.00 (53)	Total gains - internal and solar (73)m + (83)m
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) 0.10 (54)	950.39 1278.35 1631.56 1993.59 2227.27 2213.27 2117.79 1926.41 1678.63 1305.93 993.66 869.32 (84)
Enter (50) or (54) in (55) 0.10 (55)	
Water storage loss calculated for each month (55) x (41)m	7. Mean internal temperature (heating season)
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (56)	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)	Utilisation factor for gains for living area n1,m (see Table 9a)
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NHER Plan Assessor version 6.3.4	NHER Plan Assessor version 6.3.4
Page 2 SAP version 9.92	Page 3 SAP version 9.92

0.97 0.9	0.88	0.77	0.63	0.48	0.36	0.41	0.62	0.86	0.95	0.98	(86)	Water he
Mean internal temp of living area	T1 (steps 3 to	7 in Table 9c	:)									Water he
18.67 19.	09 19.66	20.27	20.68	20.89	20.96	20.95	20.77	20.16	19.29	18.60	(87)	Electricity
Temperature during heating perio	ds in the rest o	of dwelling fr	rom Table	9, Th2(°C)								
20.02 20.	02 20.03	20.04	20.04	20.05	20.05	20.06	20.05	20.04	20.04	20.03	(88)	Electricity
Utilisation factor for gains for rest	of dwelling n2	!,m										mecha
0.97 0.9	0.87	0.75	0.59	0.42	0.29	0.33	0.56	0.83	0.95	0.98	(89)	Total elec
Mean internal temperature in the	rest of dwellin	ng T2 (follow	steps 3 to	7 in Table 9	e)							Electricity
16.89 17.	49 18.31	19.16	19.69	19.96	20.03	20.02	19.83	19.03	17.79	16.80	(90)	Total deli
Living area fraction							Li	ving area ÷	(4) =	0.52	(91)	401 5
Mean internal temperature for th	e whole dwelli	ng fLA x T1 +	-(1 - fLA) x	Т2								10b. Fue
17.82 18.	33 19.01	19.74	20.21	20.45	20.52	20.51	20.32	19.62	18.57	17.74	(92)	
Apply adjustment to the mean int	ernal temperat	ture from Ta	ble 4e whe	ere appropr	iate							Space he
17.82 18.	33 19.01	19.74	20.21	20.45	20.52	20.51	20.32	19.62	18.57	17.74	(93)	Space he
						A 14						Water he
8. Space heating requirement										-		Water he
Jan Fe	b Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Pumps ar
Utilisation factor for gains, ηm			a								7 (2.1)	Electricit
0.96 0.9		0.74	0.60	0.45	0.33	0.37	0.58	0.82	0.93	0.96	(94)	Additiona
Jseful gains, nmGm, W (94)m x (			10			1		10		a	7 (07)	Total ene
	.61 1384.03		1328.59	986.71	689.26	711.31	976.18	1065.30	924.67	838.21	(95)	i otai elle
Aonthly average external temper											7	11b. SA
4.30 4.9		8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)	Energy co
leat loss rate for mean internal to								1			7	Energy co
	3.02 2348.91		1568.97		712.23	744.18	1137.63	1663.13	2128.35	2526.93	(97)	SAP value
Space heating requirement, kWh/					0.55	0.00	0.55		000 07	4055.1-	7	SAP ratin
1223.16 911	.51 717.87	387.06	178.84	0.00	0.00	0.00	0.00	444.78	866.65	1256.40		SAP band
c	27						Σ(9)	8)15, 10		986.28	(98)	12b. CO
Space heating requirement kWh/	n-/year							(98)	÷ (4)	34.07	(99)	120.00
9b. Energy requirements - comm	unity heating	scheme										
Fraction of space heat from secor	dary/suppleme	entary syster	m (table 1:	1)				'0' if	none	0.00	(301)	Emission
Fraction of space heat from comn	unity system							1 - (3	01) =	1.00	(302)	Power ef
Fraction of community heat from	boilers									0.30	(303a)	Heat effic
Fraction of community heat from	СНР									0.70	(303b)	Space he
Fraction of total space heat from	community CH	P						(302) x (30	3a) =	0.70	(304a)	less cr
Fraction of total space heat from								(302) x (30		0.30	(304b)	Water he
Factor for control and charging m			munity sp	ace heating						1.00	(305)	less ci
Factor for charging method (Table	4c(3)) for com	nmunity wate	er heating	-						1.00	(305a)	Emission
Distribution loss factor (Table 12c										1.05	(306)	Efficiency
											_	CO2 emis
Space heating												Electrical
Annual space heating requiremen	t					5	986.28	]			(98)	Total CO:
Space heat from CHP						(98	3) x (304a) :	x (305) x (3	06) = 4	399.91	(307a)	Total CO
Space heat from boilers						(98	3) x (304b) :	x (305) x (3		.885.68	(307b)	Pumps ar
							. ,					Electricity
Water heating												Total CO;
Annual water heating requiremen	t					1	960.00	]			(64)	Dwelling
								-			(* ) (	Dwennig
										KCS1-A1 v		
				Page 4				NE	IER Plan As		ion 6.3.4 sion 9.92	
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om CHP	(64) x (303a) x (305a) x (306) =	1440.60	(310a)
om boilers	(64) x (303b) x (305a) x (306) =	617.40	(310b)
d for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	83.44	(313)
pumps, fans and electric keep-hot (Table 4f)			
ventilation fans - balanced, extract or positive input fr	om outside 383.38		(330a)
y for the above, kWh/year		383.38	(331)
ighting (Appendix L)		546.80	(332)
d energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)(337b) =	9273.77	(338)

ts - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
pace heating from CHP	4399.91	х	2.97	x 0.01 =	130.68	(340a)
pace heating from boilers	1885.68	x	4.24	x 0.01 =	79.95	(340b)
Vater heating from CHP	1440.60	x	2.97	x 0.01 =	42.79	(342a)
Vater heating from boilers	617.40	x	4.24	x 0.01 =	26.18	(342b)
umps and fans	383.38	x	13.19	x 0.01 =	50.57	(349)
lectricity for lighting	546.80	x	13.19	x 0.01 =	72.12	(350)
dditional standing charges					120.00	(351)
otal energy cost			(340a)(342e) + (34	45)(354) =	522.28	(355)
11b. SAP rating - community heating scheme						
nergy cost deflator (Table 12)					0.42	(356)
nergy cost factor (ECF)					0.99	(357)

ction 13)

		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CH	P (space and water heating)						
Power efficiency of CHP unit		31.50					(361)
Heat efficiency of CHP unit		48.50					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	9071.2496	х	0.2160	=	1959.3899	(363)
less credit emissions for ele	ectricity	-2857.0865	х	0.5190	=	-1482.8279	(364)
Water heated by CHP		2970.0618	х	0.2160	=	641.5334	(365)
less credit emissions for ele	ectricity	-935.4525	х	0.5190	=	-485.4999	(366)
Emissions from other sources	(space heating)						
Efficiency of boilers		91.80					(367b
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	2726.66	х	0.216	=	588.96	(368)
Electrical energy for communit	ty heat distribution	83.44	х	0.519	=	43.30	(372)
Total CO2 associated with com	imunity systems				[	1264.86	(373)
Total CO2 associated with space	ce and water heating				[	1264.86	(376)
Pumps and fans		383.38	х	0.519	=	198.98	(378)
Electricity for lighting		546.80	х	0.519	=	283.79	(379)
Total CO₂, kg/year					(376)(382) =	1747.62	(383)
Dwelling CO <sub>2</sub> emission rate					(383) ÷ (4) =	9.95	(384)

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86.13

86

В

(358)

#### EI value

El rating (section 14)

EI band

### 13b. Primary energy - community heating scheme

135. Filmary energy - community nearing scheme	Energy		Primary factor	Primary energy	
	kWh/year				(kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.50				(361)
Heat efficiency of CHP unit	48.50				(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	9071.25	х	1.22	=	11066.92 (363)
less credit energy for electricity	-2857.09	х	3.07	=	-8771.26 (364)
Water heated by CHP	2970.06	х	1.22	=	3623.48 (365)
less credit energy for electricity	-935.45	х	3.07	=	-2871.84 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	91.80				(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) =	2726.66	x	1.22	=	3326.53 (368)
Electrical energy for community heat distribution	83.44	x	3.07	=	256.15 (372)
Total primary energy associated with community systems					6629.98 (373)
Total primary energy associated with space and water heating					6629.98 <b>(376)</b>
Pumps and fans	383.38	x	3.07	=	1176.98 (378)
Electricity for lighting	546.80	x	3.07	=	1678.67 (379)
Primary energy kWh/year					9485.63 (383)
Dwelling primary energy rate kWh/m2/year					53.99 (384)

### **DER Worksheet**

89.39

89

В

(385)



Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name Mr	r Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address A1,	, London		

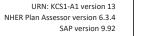
### 1. Overall dwelling dimensions

		Area (m²)		Average storey height (m)	Volume (m³)
Lowest occupied		110.05 (1a)	x	2.70 (2a) =	297.14 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	110.05 (4)			
Dwelling volume				(3a) + (3b) + (3c) + (3d)(3n) =	= 297.14 (5)

### 2. Ventilation rate

											n	<sup>3</sup> per hour	
Number of chimr	neys								0	x 40 =	-	0	(6a)
Number of open	flues								0	x 20 =	-	0	(6b)
Number of interr	nittent fan	S							0	x 10 =	-	0	(7a)
Number of passiv	ve vents								0	x 10 =	-	0	(7b)
Number of fluele	ss gas fires	5							0	x 40 =	-	0	(7c)
											Air	changes pe hour	r
Infiltration due to	o chimneys	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	÷ (5) :	-	0.00	(8)
If a pressurisation	n test has l	been carried	d out or is i	ntended, pr	oceed to (1	7), otherw	ise continue	e from (9) t	o (16)				
Air permeability	value, q50	, expressed	in cubic m	etres per ho	our per squ	are metre	of envelope	area				3.00	(17)
If based on air pe	ermeability	value, the	n (18) = [(1	7) ÷ 20] + (8	8), otherwis	e (18) = (16	5)					0.15	(18)
Number of sides	on which t	he dwelling	g is sheltere	ed								1	(19)
Shelter factor									1 -	[0.075 x (1	.9)] =	0.93	(20)
Infiltration rate in	ncorporati	ng shelter f	actor							(18) x (	20) =	0.14	(21)
Infiltration rate n	nodified fo	r monthly v	wind speed	:									
Infiltration rate n	nodified fo Jan	r monthly v Feb	wind speed Mar	: Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Infiltration rate n Monthly average	Jan	Feb	Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Jan	Feb	Mar		<b>May</b> 4.30	Jun 3.80	Jul 3.80	<b>Aug</b> 3.70	<b>Sep</b>	<b>Oct</b> 4.30	<b>Nov</b>	<b>Dec</b> 4.70	(22)
	Jan wind spee 5.10	Feb ed from Tab	Mar ile U2	Apr					-				] (22)
Monthly average	Jan wind spee 5.10	Feb ed from Tab	Mar ile U2	Apr					-				] (22) ] (22a)
Monthly average	Jan wind spee 5.10 m ÷ 4 1.28	Feb ed from Tab 5.00 1.25	Mar Ne U2 4.90 1.23	Apr 4.40 1.10	4.30	3.80 0.95	3.80	3.70	4.00	4.30	4.50	4.70	
Monthly average [ Wind factor (22)r [	Jan wind spee 5.10 m ÷ 4 1.28	Feb ed from Tab 5.00 1.25	Mar Ne U2 4.90 1.23	Apr 4.40 1.10	4.30	3.80 0.95	3.80	3.70	4.00	4.30	4.50	4.70	
Monthly average [ Wind factor (22)r [	Jan wind spee 5.10 m ÷ 4 1.28 ion rate (a 0.18	Feb           ed from Tab           5.00           1.25           llowing for           0.17	Mar le U2 4.90 1.23 shelter and 0.17	Apr 4.40 1.10 Wind facto 0.15	4.30 1.08 pr) (21) x (2	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	4.30	4.50	4.70	] (22a)
Monthly average   Wind factor (22)r   Adjusted infiltrat	Jan wind spee 5.10 m ÷ 4 1.28 ion rate (a 0.18 re air chan	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for	Mar Ne U2 4.90 1.23 shelter and 0.17 the applica	Apr 4.40 1.10 4 wind facto 0.15 ble case:	4.30 1.08 or) (21) x (2 0.15	3.80 0.95 2a)m	3.80 0.95	3.70 0.93	4.00	4.30	4.50	4.70	] (22a)
Monthly average [ Wind factor (22)r [ Adjusted infiltrat [ Calculate effectiv	Jan wind spee 5.10 n ÷ 4 1.28 ion rate (a 0.18 re air chan; ventilatior	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for the the air chang	Mar ble U2 4.90 1.23 shelter and 0.17 the applica e rate throu	Apr 4.40 1.10 4 wind facto 0.15 ble case: ugh system	4.30 1.08 or) (21) x (2 0.15	3.80 0.95 2a)m 0.13	3.80 0.95 0.13	3.70 0.93	4.00	4.30	4.50	4.70	] (22a) ] (22b)
Monthly average [ Wind factor (22)r [ Adjusted infiltrat [ Calculate effectiv If mechanical	Jan wind spee 5.10 n ÷ 4 1.28 ion rate (a 0.18 re air chan; ventilatior th heat re	Feb ed from Table 5.00 1.25 Ilowing for 0.17 ge rate for for the air chang covery: efficience	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throi ciency in %	Apr 4.40 1.10 Wind factor 0.15 ble case: ugh system allowing for	4.30 1.08 or) (21) x (2 0.15	3.80 0.95 2a)m 0.13	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16	] (22a) ] (22b) ] (23a)
Monthly average [ Wind factor (22)r [ Adjusted infiltrat [ Calculate effectiv If mechanical If balanced wi	Jan wind spee 5.10 n ÷ 4 1.28 ion rate (a 0.18 re air chan; ventilatior th heat re	Feb ed from Table 5.00 1.25 Ilowing for 0.17 ge rate for for the air chang covery: efficience	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throi ciency in %	Apr 4.40 1.10 Wind factor 0.15 ble case: ugh system allowing for	4.30 1.08 or) (21) x (2 0.15	3.80 0.95 2a)m 0.13	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16	] (22a) ] (22b) ] (23a)
Monthly average [ Wind factor (22)r [ Adjusted infiltrat [ Calculate effectiv If mechanical If balanced wi	Jan wind spee 5.10 n ÷ 4 1.28 ion rate (a 0.18 re air chan, ventilatior th heat re- mechanic 0.28	Feb ed from Tab 5.00 1.25 Ilowing for 0.17 ge rate for 1 a: air chang covery: effi al ventilatic 0.27	Mar le U2 4.90 1.23 shelter and 0.17 the applica e rate throw ciency in % on with hea 0.27	Apr 4.40 1.10 I wind facto 0.15 ble case: ugh system allowing fo t recovery ( 0.25	4.30 1.08 rr) (21) x (2 0.15 or in-use fac (MVHR) (22 0.25	3.80 0.95 2a)m 0.13 ctor from T.	3.80 0.95 0.13 able 4h	3.70 0.93 0.13	4.00	4.30	4.50	4.70 1.18 0.16 0.50 79.90	] (22a) ] (22b) ] (22b) ] (23a) ] (23c)

Page 1



3. Heat losses and heat loss parameter	3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)
Element Gross Openings Net area U-value A x U W/K κ-value, A x κ,	Primary circuit loss for each month from Table 3
area, m² M, m² W/m²K kJ/m².K kJ/K	23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26 22.51 23.26 (59)
Window 40.70 x 1.05 = 42.88 (27)	Combi loss for each month from Table 3a, 3b or 3c
Ground floor 110.05 x 0.09 = 9.90 (28a)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)
External wall 74.41 x 0.18 = 13.39 (29a)	Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$
Party wall 21.57 x 0.00 = 0.00 (32)	191.36 168.12 175.28 155.36 150.96 133.05 126.02 140.71 141.21 161.19 172.66 186.15 (62)
Total area of external elements $\Sigma A$ , m <sup>2</sup> 225.16 (31)	Solar DHW input calculated using Appendix G or Appendix H
Fabric heat loss, $W/K = \Sigma(A \times U)$ (26)(30) + (32) = 66.18 (33)	
Heat capacity $Cm = \sum (A \times K)$ (28)(30) + (32) + (32a)(32e) = N/A (34)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K (35)	
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Appendix K (36)	191.36 168.12 175.28 155.36 150.96 133.05 126.02 140.71 141.21 161.19 172.66 186.15
	$\Sigma(64)112 = 1902.08 $ (64)
	Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
	76.01         67.09         70.67         63.65         62.58         56.23         54.29         59.17         58.94         65.98         69.40         74.28         (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	5. Internal gains
27.20 26.86 26.52 24.82 24.48 22.78 22.78 22.44 23.46 24.48 25.16 25.84 (38)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coefficient, W/K (37)m + (38)m	
127.16 126.82 126.48 124.78 124.44 122.73 122.73 122.39 123.41 124.44 125.12 125.80	Metabolic gains (Table 5)
Average = $\Sigma(39)112/12$ = 124.69 (39)	<u>140.76</u> <u>(66)</u>
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
1.16         1.15         1.13         1.13         1.12         1.11         1.12         1.13         1.14         1.14	24.22         21.51         17.49         13.24         9.90         8.36         9.03         11.74         15.75         20.00         23.35         24.89         (67)
Average = $\sum (40)112/12 = 1.13$ (40)	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
Number of days in month (Table 1a)	271.63 274.45 267.34 252.22 233.13 215.19 203.21 200.39 207.49 222.62 241.70 259.64 (68)
31.00         28.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         400	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
	37.08         37.08 <th< td=""></th<>
4. Water heating energy requirement	Pump and fan gains (Table 5a)
Assumed occupancy, N 2.82 (42)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 [101.06] (43)	Losses e.g. evaporation (Table 5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	-112.61 -112.6
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	Water heating gains (Table 5)
111.17         107.12         103.08         99.04         95.00         90.95         95.00         99.04         103.08         107.12         111.17	102.17         99.84         94.99         88.40         84.12         78.09         72.97         79.53         81.87         88.69         96.39         99.85         (72)
$\Sigma(44)112 = 1212.71 $ (44)	Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	463.24 461.02 445.05 419.09 392.38 366.87 350.44 356.89 370.34 396.53 426.67 449.60 (73)
164.85         144.18         148.78         129.71         124.46         107.40         99.52         114.21         115.57         134.68         147.02         159.65	
$\Sigma(45)112 = 1590.06$ (45)	6. Solar gains
Distribution loss 0.15 x (45)m	Access factor Area Solar flux g FF Gains
24.73 21.63 22.32 19.46 18.67 16.11 14.93 17.13 17.34 20.20 22.05 23.95 (46)	Table 6d         m <sup>2</sup> W/m <sup>2</sup> specific data         W           or Table 6b         or Table 6c         or Table 6c         or Table 6c         or Table 6c
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00 (47)	East 0.77 x 14.57 x 19.64 x 0.9 x 0.55 x 0.80 = 87.26 (76)
Water storage loss:	
b) Manufacturer's declared loss factor is not known	South $0.77 \times 9.83 \times 46.75 \times 0.9 \times 0.55 \times 0.80 = 140.13$ (78)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)	West $0.77 \times 16.30 \times 19.64 \times 0.9 \times 0.55 \times 0.80 = 97.62$ (80)
Volume factor from Table 2a 4.93 (52)	Solar gains in watts ∑(74)m(82)m
Temperature factor from Table 2b [1.00] (53)	325.00         591.15         887.93         1199.03         1408.84         1421.09         1361.22         1205.58         998.08         676.66         396.62         273.12         (83)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) 0.10 (54)	Total gains - internal and solar (73)m + (83)m
	788.24 1052.17 1332.98 1618.12 1801.22 1787.96 1711.66 1562.47 1368.42 1073.20 823.28 722.72 (84)
Enter (50) or (54) in (55) 0.10 (55)	7. Mean internal temperature (heating season)
Water storage loss calculated for each month (55) x (41)m	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
3.24 2.92 3.24 3.13 3.24 3.13 3.24 3.13 3.24 3.13 (56)	
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
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NHER Plan Assessor version 6.3.4	NHER Plan Assessor version 6.3.4
Page 2 SAP version 9.92	Page 3 SAP version 9.92

	0.95	0.91	0.83	0.70	0.55	0.41	0.31	0.34	0.54	0.79	0.92	0.96	(86)
Mean internal te	mp of livin	g area T1 (s	teps 3 to 7	in Table 90	:)								
	18.77	19.23	19.81	20.38	20.74	20.91	20.97	20.96	20.82	20.27	19.40	18.69	(87)
Temperature du	ring heating	g periods in	the rest o	f dwelling f	rom Table	9, Th2(°C)							
	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)
Utilisation factor	for gains f	or rest of d	welling n2,	m									
	0.94	0.89	0.80	0.67	0.51	0.35	0.24	0.27	0.48	0.75	0.91	0.95	(89)
Mean internal te	mperature	in the rest	of dwelling	g T2 (follow	steps 3 to	7 in Table	Эс)						
	17.00	17.65	18.46	19.24	19.70	19.92	19.97	19.96	19.81	19.12	17.91	16.88	(90)
Living area fracti	on								L	iving area ÷	(4) =	0.38	(91)
Mean internal te	mperature	for the wh	ole dwellin	g fLA x T1 +	+(1 - fLA) x	T2							
	17.67	18.25	18.98	19.68	20.09	20.30	20.35	20.34	20.20	19.56	18.48	17.57	(92)
Apply adjustmer	nt to the me	an internal	l temperat	ure from Ta	ble 4e whe	ere approp	iate						
	17.67	18.25	18.98	19.68	20.09	20.30	20.35	20.34	20.20	19.56	18.48	17.57	(93)
9 Crass heatin	a roquiror	ont											
8. Space heatin				A			ted.	A	6	0.4	New	Dee	
Utilization factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor			0.70	0.05	0.51	0.07	0.20	0.20	0.40	0.74	0.00	0.02	
Usoful gains am	0.92	0.87	0.78	0.65	0.51	0.37	0.26	0.30	0.49	0.74	0.88	0.93	(94)
Useful gains, ηm				1050.62	022.52	662.05	450.00	467.05	674.17	792.78	707.01	675 44	(05)
Monthly average	727.25	911.71	1041.00		923.52	662.85	450.08	467.85	674.17	/92.78	727.91	675.41	(95)
wontiny average	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo							16.60	10.40	14.10	10.60	7.10	4.20	] (90)
neat loss late lo	1700.39		1577.84			699.01	460.40	482.62	752.30	1114.68	1423.42	1681.75	(97)
Space heating re							400.40	402.02	732.30	1114.08	1423.42	1081.75	] (57)
Space nearing re	724.01	525.32	399.41	205.24	89.91	0.00	0.00	0.00	0.00	239.49	500.76	748.72	1
	724.01	525.52	5555.41	203.24	85.51	0.00	0.00	0.00	1	18)15, 10	·	3432.87	 (98)
Space heating re	quirement	kWh/m²/v	ear						213		÷ (4)	31.19	(99)
opuce neuting re	quirement		cui							(50)	. (-)	51.15	
9b. Energy requ	uirements -	communit	y heating s	cheme									
Fraction of space	e heat from	secondary	/suppleme	ntary syste	m (table 12	1)				'0' if	none	0.00	(301)
Fraction of space	e heat from	community	y system							1 - (3	01) =	1.00	(302)
Fraction of comr	nunity heat	; from boile	rs									0.30	(303a)
Fraction of comr	nunity heat	from CHP										0.70	(303b)
Fraction of total	space heat	from comn	nunity CHP							(302) x (30	3a) =	0.70	(304a)
Fraction of total	space heat	from comn	nunity boil	ers						(302) x (30	3b) =	0.30	(304b)
Factor for contro	l and charg	ging method	d (Table 4c	(3)) for com	nmunity sp	ace heating						1.00	(305)
Factor for chargi	ng method	(Table 4c(3	3)) for com	munity wat	er heating							1.00	(305a)
Distribution loss	factor (Tab	le 12c) for o	community	/ heating sy	stem							1.05	(306)
Space heating													
Annual space he	ating requi	rement							3432.87				(98)
	CHP							(9	8) x (304a)	x (305) x (3	06) =	2523.16	(307a)
Space heat from	hoilers							(9)	8) x (304b)	x (305) x (3	06) =	1081.35	(307b)
Space heat from Space heat from	bollers												
•	bollers												

1902.08 (64) Annual water heating requirement (64) x (303a) x (305a) x (306) = 1398.03 (310a) Water heat from CHP (64) x (303b) x (305a) x (306) = Water heat from boilers 599.15 (310b) Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 56.02 (313) Electricity for pumps, fans and electric keep-hot (Table 4f) 240.16 (330a) mechanical ventilation fans - balanced, extract or positive input from outside Total electricity for the above, kWh/year 240.16 (331) Electricity for lighting (Appendix L) 427.66 (332) Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 6269.51 (338) 10b. Fuel costs - community heating scheme Fuel Fuel Fuel price kWh/year cost £/year Space heating from CHP 2523.16 2.97 x 0.01 = 74.94 (340a) x Space heating from boilers 1081.35 4.24 x 0.01 = 45.85 (340b) х Water heating from CHP 1398.03 2.97 x 0.01 = 41.52 (342a) х Water heating from boilers 599.15 4.24 x 0.01 = 25.40 (342b) x Pumps and fans 240.16 13.19 x 0.01 = 31.68 х (349) Electricity for lighting 427.66 13.19 x 0.01 = 56.41 (350) Additional standing charges 120.00 (351) (340a)...(342e) + (345)...(354) = 395.80 (355) Total energy cost 11b. SAP rating - community heating scheme Energy cost deflator (Table 12) 0.42 (356) Energy cost factor (ECF) 1.07 (357) SAP value 85.04 85 SAP rating (section 13) (358) SAP band В 12b. CO<sub>2</sub> emissions - community heating scheme Energy Emission factor Emissions

		kWh/year				(kg/year)	
Emissions from community CH	IP (space and water heating)						
Power efficiency of CHP unit		31.50					(361)
Heat efficiency of CHP unit		48.50					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	5201.9677	х	0.2160	=	1123.6250	(363)
less credit emissions for el	ectricity	-1638.4150	х	0.5190	= [	-850.3374	(364)
Water heated by CHP		2882.2936	х	0.2160	=	622.5754	(365)
less credit emissions for el	ectricity	-907.8090	х	0.5190	= [	-471.1529	(366)
Emissions from other sources	(space heating)						
Efficiency of boilers		91.80					(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	1830.62	х	0.216	=	395.41	(368)
Electrical energy for communi	ty heat distribution	56.02	х	0.519	= [	29.07	(372)
Total CO2 associated with con	nmunity systems				[	849.20	(373)
Total CO2 associated with spa	ce and water heating				[	849.20	(376)
Pumps and fans		240.16	х	0.519	= [	124.64	(378)
Electricity for lighting		427.66	х	0.519	=	221.95	(379)
Total CO <sub>2</sub> , kg/year					(376)(382) =	1195.79	(383)

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Dwelling CO₂ emission rate
El value
El rating (section 14)
EI band

#### (383) ÷ (4) = 10.87 (384) 89.67 90 (385) В

### 13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.50	]			(361)
Heat efficiency of CHP unit	48.50	]			(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	5201.97	x	1.22	=	6346.40 (363)
less credit energy for electricity	-1638.42	x	3.07	=	-5029.93 (364)
Water heated by CHP	2882.29	x	1.22	=	3516.40 (365)
less credit energy for electricity	-907.81	x	3.07	=	-2786.97 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	91.80				(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) =	1830.62	x	1.22	=	2233.35 (368)
Electrical energy for community heat distribution	56.02	) x	3.07	=	171.97 ( <mark>372)</mark>
Total primary energy associated with community systems					4451.22 (373)
Total primary energy associated with space and water heating					4451.22 (376)
Pumps and fans	240.16	x	3.07	=	737.29 (378)
Electricity for lighting	427.66	x	3.07	=	1312.91 (379)
Primary energy kWh/year					6501.42 (383)
Dwelling primary energy rate kWh/m2/year					59.08 <b>(384)</b>

## **DER Worksheet**



### Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address	TH A1, London		

	dimensions

		Area (m²)		Average storey height (m)		Volume (m³)
Lowest occupied	[	69.47 (1a)	x	2.70 (	2a) =	187.57 (3a)
+1		41.56 (1b)	x	3.15 (	2b) =	130.91 (3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	111.03 (4)				
Dwelling volume				(3a) + (3b) + (3c)	+ (3d)(3n) =	318.48 (5)

2. Ventilation rate

											m	<sup>3</sup> per hour	
Number of chim	neys								0	] x 40 =	-	0	(6a)
Number of open	flues								0	] x 20 =	-	0	(6b)
Number of inter	mittent fan	s							0	) x 10 =	-	0	(7a)
Number of passi	ve vents								0	] x 10 =	-	0	(7b)
Number of fluele	ess gas fires	5							0	] x 40 =		0	(7c)
											Airo	hanges per hour	r
Infiltration due t	o chimneys	, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	) ÷ (5) =	-	0.00	(8)
lf a pressurisatio	n test has l	peen carrie	d out or is ii	ntended, pr	oceed to (1	17), otherw	ise continue	e from (9) t	o (16)				
Air permeability	value, q50,	expressed	in cubic me	etres per ho	our per squ	are metre	of envelope	e area				3.00	(17)
If based on air p	ermeability	value, the	n (18) = [(17	7) ÷ 20] + (8	s), otherwis	e (18) = (16	5)					0.15	(18)
Number of sides	on which t	he dwelling	g is sheltere	d								1	(19)
Shelter factor									1 -	[0.075 x (1	9)] =	0.93	(20)
Infiltration rate i	ncorporati	ng shelter f	actor							(18) x (2	20) =	0.14	(21)
Infiltration rate	modified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	e wind spee	d from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)	m÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltrat	tion rate (a	llowing for	shelter and	l wind facto	or) (21) x (2	2a)m							
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	(22b)
Calculate effection	ve air chan	ge rate for	the applical	ble case:									
If mechanical	l ventilatior	1: air chang	e rate throu	ugh system								0.50	(23a)
If balanced w	ith heat re	covery: effi	ciency in %	allowing fo	or in-use fac	ctor from T	able 4h					79.90	(23c)
a) If balanced	l mechanica	al ventilatio	on with hea	t recovery (	MVHR) (22	2b)m + (23b	o) x [1 - (23d	c) ÷ 100]					
	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(24a)

Page 1

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)



SAP version 9.92

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0.28 0.27 0.27 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.26 0.26	(25) <u>3.24 2.92 3.24 3.13 3.24 3.13 3.24 3.24 3.13 3.24 (56)</u>
3. Heat losses and heat loss parameter	If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)
Element Gross Openings Net area U-value A x U W/K κ-value, A x κ,	3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.24         3.13         3.24         57
area, $m^2$ m <sup>2</sup> A, $m^2$ W/m <sup>2</sup> K kl/K kl/k	Primary circuit loss for each month from Table 3
Window 33.63 x 1.05 = 35.43	(27) 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59)
	(28b) Combi loss for each month from Table 3a, 3b or 3c
	(23)         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         (61)
	Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$
	(32) 191.58 168.31 175.49 155.53 151.13 133.19 126.16 140.86 141.37 161.37 172.86 186.37 (62)
	(30) Solar DHW input calculated using Appendix G or Appendix H
	(31) 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
	(33) Output from water heater for each month (kWh/month) (62)m + (63)m
Heat capacity $Cm = \sum (A \times \kappa)$ (28)(30) + (32) + (32a)(32e) = N/A	(34) 191.58 168.31 175.49 155.53 151.13 133.19 126.16 140.86 141.37 161.37 172.86 186.37
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K 100.00	
Thermal bridges: $\Sigma(L x \Psi)$ calculated using Appendix K 42.35	(36) $\Sigma(64)112 = 1904.22  (64)$
Total fabric heat loss         (33) + (36) = 116.29	(37) Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	76.09         67.15         70.74         63.70         62.64         56.28         54.34         59.22         59.00         66.04         69.47         74.36         (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	5. Internal gains
29.16 28.79 28.43 26.60 26.24 24.42 24.42 24.05 25.15 26.24 26.97 27.70	
Heat transfer coefficient, W/K (37)m + (38)m	Metabolic gains (Table 5)
145.45 145.08 144.72 142.89 142.53 140.71 140.71 140.34 141.44 142.53 143.26 143.99	
	(39) Lighting gains (calculated in Appendix L counting 1.9 or 1.9 ) also see Table 5
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	Lighting gains (calculated in Appendix 2, equation 25 of 15a), also see Table 5
1.31         1.30         1.29         1.28         1.27         1.26         1.27         1.28         1.29         1.30	24.34       21.62       17.58       13.31       9.95       8.40       9.08       11.80       15.84       20.11       23.47       25.02       (67)
	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
	(40) 273.03 275.86 268.72 253.52 234.34 216.30 204.26 201.42 208.56 223.76 242.95 260.98 (68)
Number of days in month (Table 1a)	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
31.00         28.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00	(40) 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 37.10 (59)
4. Water heating energy requirement	Pump and fan gains (Table 5a)
	(42)
	(42) Losses e.g. evaporation (Table 5)
	-112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 -112.83 (71)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Water heating gains (Table 5)
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	102.27 99.93 95.08 88.48 84.19 78.16 73.03 79.60 81.94 88.77 96.48 99.94 (72)
111.32         107.27         103.22         99.17         95.12         91.08         91.08         95.12         99.17         103.22         107.27         111.32	Total internal gains. (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
$\sum (44)112 = 1214.35$	(44) 464.95 462.72 446.69 420.62 393.79 368.18 351.68 358.14 371.65 397.95 428.21 451.25 (73)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	(1)
165.08         144.38         148.98         129.89         124.63         107.55         99.66         114.36         115.73         134.87         147.22         159.87	6. Solar gains
$\Sigma(45)112 = 1592.20$	(45) Access factor Area Solar flux g FF Gains
Distribution loss 0.15 x (45)m	Table 6d         m²         W/m²         specific data         W
24.76         21.66         22.35         19.48         18.69         16.13         14.95         17.15         17.36         20.23         22.08         23.98	(46) or Table 6b or Table 6c
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00	(47) East 0.77 x 27.91 x 19.64 x 0.9 x 0.55 x 0.80 = 167.14 (76)
Water storage loss:	West 0.77 x 5.72 x 19.64 x 0.9 x 0.55 x 0.80 = 34.26 (80)
b) Manufacturer's declared loss factor is not known	Solar gains in watts ∑(74)m(82)m
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02	(51) 201.40 393.98 648.83 946.28 1159.70 1187.16 1130.23 970.85 754.62 467.49 251.12 165.62 (83)
	(52) Total gains - internal and solar (73)m + (83)m
	(52) 666.35 856.71 1095.53 1366.91 1553.50 1555.34 1481.91 1328.99 1126.27 865.44 679.33 616.87 (84)
	7. Mean internal temperature (neating season)
	(55) Temperature during heating periods in the living area from Table 9, Th1(°C) [21.00 (85)
Water storage loss calculated for each month (55) x (41)m	
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Page 2 SAP versio	

	lan	Feb	Mar		Mari	lum.	1.1	A.u.a	Com	Oct	Neu	Dec	
Utilisation facto	Jan r for gains f			<b>Apr</b> e Table 9a)	May	Jun	Jul	Aug	Sep	000	Nov	Dec	
	0.97	0.94	0.89	0.79	0.65	0.50	0.39	0.44	0.66	0.87	0.95	0.97	(86)
Mean internal te						0.50	0.55	0.44	0.00	0.07	0.55	0.57	] (00)
	18.28	18.67	19.28	20.00	20.52	20.82	20.93	20.91	20.64	19.87	18.94	18.21	(87)
Temperature du													] (=: )
	19.83	19.84	19.84	19.85	19.85	19.87	19.87	19.87	19.86	19.85	19.85	19.84	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,										
	0.96	0.93	0.87	0.76	0.60	0.43	0.30	0.35	0.59	0.84	0.94	0.97	(89)
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	Эс)						
	16.22	16.78	17.66	18.65	19.34	19.71	19.83	19.81	19.52	18.52	17.18	16.13	(90)
Living area fract	ion					•			Li	ving area ÷	(4) =	0.45	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	(1 - fLA) x	Т2							_
	17.15	17.63	18.39	19.26	19.87	20.21	20.32	20.30	20.02	19.13	17.97	17.07	(92)
Apply adjustmer	nt to the me	ean internal	temperati	ure from Ta	ble 4e whe	ere appropr	iate						_
	17.15	17.63	18.39	19.26	19.87	20.21	20.32	20.30	20.02	19.13	17.97	17.07	(93)
						•							-
8. Space heating										_			
	Jan	Feb	Mar	Apr	May	Jun	lut	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ηm											_
	0.94	0.91	0.85	0.74	0.60	0.46	0.34	0.38	0.60	0.82	0.92	0.95	(94)
Useful gains, ηm							-						-
	629.67	779.35	925.83	1007.18	935.26	708.49	496.93	509.65	675.52	707.78	625.42	587.72	(95)
Monthly average	e external t	emperature	from Tabl	e U1									_
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo	or mean inte	ernal tempe	rature, Lm	, W [(39)m	x [(93)m -	(96)ml							
													-
	1868.49	1846.58	1720.27	1480.04	1164.42	789.51	523.86	547.60	837.64	1215.64	1557.26	1852.91	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (95	1164.42 5)m] x (41)	789.51							<b>(97)</b>
Space heating re					1164.42	789.51	0.00	0.00	0.00	377.85	670.93	941.31	]
	equirement 921.68	, kWh/mon 717.18	th 0.024 x 591.06	[(97)m - (95	1164.42 5)m] x (41)	789.51			0.00	377.85 8)15, 10	670.93	941.31 4730.96	] (98)
	equirement 921.68	, kWh/mon 717.18	th 0.024 x 591.06	[(97)m - (95	1164.42 5)m] x (41)	789.51			0.00	377.85 8)15, 10	670.93	941.31	]
	equirement 921.68 equirement	, kWh/mon 717.18 kWh/m²/ye	th 0.024 x 591.06 ear	[(97)m - (99 340.45	1164.42 5)m] x (41)	789.51			0.00	377.85 8)15, 10	670.93	941.31 4730.96	] (98)
Space heating re	equirement 921.68 equirement	kWh/mon 717.18 kWh/m²/ye	th 0.024 x 591.06 ear y heating s	[(97)m - (95 340.45 cheme	1164.42 5)m] x (41) 170.50	789.51 m 0.00			0.00	377.85 8)15, 10 (98)	670.93	941.31 4730.96	] (98) ] (99)
Space heating re 9b. Energy req Fraction of space	equirement 921.68 equirement uirements	kWh/mon 717.18 kWh/m²/ye communit	th 0.024 x 591.06 ear y heating s /suppleme	[(97)m - (95 340.45 cheme	1164.42 5)m] x (41) 170.50	789.51 m 0.00			0.00	377.85 8)15, 10 (98) '0' if	670.93 12 = 4 ÷ (4)	941.31 1730.96 42.61	] (98) ] (99) ] (301
Space heating req 9b. Energy req Fraction of space Fraction of space	equirement 921.68 equirement uirements e heat from e heat from	, kWh/mon 717.18 kWh/m²/ye communit secondary, communit	th 0.024 x 591.06 ear y heating s /suppleme y system	[(97)m - (95 340.45 cheme	1164.42 5)m] x (41) 170.50	789.51 m 0.00			0.00	377.85 8)15, 10 (98) '0' if	670.93 .12 = ÷ (4) none	941.31 4730.96 42.61 0.00	] (98) ] (99) ] (301 ] (302
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of com	equirement 921.68 equirement uirements e heat from munity hea	kWh/mon 717.18 kWh/m²/ye communit secondary, communit	th 0.024 x 591.06 ear y heating s /suppleme y system	[(97)m - (95 340.45 cheme	1164.42 5)m] x (41) 170.50	789.51 m 0.00			0.00	377.85 8)15, 10 (98) '0' if	670.93 .12 = ÷ (4) none	941.31 4730.96 42.61 0.00 1.00	] (98) ] (99) ] (301 ] (302 ] (303
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of com Fraction of com	equirement 921.68 equirement e heat from e heat from munity hea munity hea	, kWh/mon 717.18 kWh/m²/ya communit secondary, communit t from boile t from CHP	th 0.024 x 591.06 ear y heating s y heating s y system rs	((97)m - (9! 340.45 cheme ntary system	1164.42 5)m] x (41) 170.50	789.51 m 0.00			<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if	670.93 12 = 4 ÷ (4) (1) none (1) 01) = (1)	941.31 4730.96 42.61 0.00 1.00 0.30	] (98) ] (99) ] (301 ] (302 ] (303 ] (303
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of com Fraction of com Fraction of com Fraction of total	equirement 921.68 equirement uirements e heat from e heat from munity hea munity hea l space heat	kWh/mon 717.18 kWh/m <sup>2</sup> /ye communit secondary, communit t from boile t from CHP from comm	th 0.024 x 591.06 ear <b>y heating s</b> /suppleme y system rs	((97)m - (9! 340.45 cheme ntary syster	1164.42 5)m] x (41) 170.50	789.51 m 0.00			<u>0.00</u> Σ(9)	377.85 B)15, 10 (98) '0' if 1 - (3	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70	) (98) ) (99) ) (301 ) (302 ) (303 ) (303 ) (304
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of come Fraction of come Fraction of total Fraction of total	equirement 921.68 equirement uirements e heat from e heat from munity hea munity hea l space heat l space heat	kWh/mon 717.18 kWh/m <sup>2</sup> /ye communit secondary, communit t from boile t from CHP from comm	th 0.024 x 591.06 ear <b>y heating s</b> /suppleme y system rs nunity CHP nunity boil	((97)m - (9! 340.45 cheme ntary system	1164.42 5)m] x (41) 170.50	789.51 m 0.00	0.00		<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.70	) (98) (99) (301 (302 (303 (303 ) (304 ) (304
Space heating re <b>9b. Energy req</b> Fraction of space Fraction of space Fraction of come Fraction of come Fraction of total Fraction of total Fraction of total Fractor for contro	equirement 921.68 equirement e heat from e heat from munity hea I space heat I space heat ol and charg	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging method	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild	((97)m - (9) 340.45 cheme ntary system ers (3)) for com	1164.42 5)m] x (41) 170.50 n (table 11	789.51 m 0.00	0.00		<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.70 0.30	) (98) ) (99) ) (301 ) (302 ) (303 ] (303 ] (304 ] (304 ] (305
Space heating re <b>9b. Energy req</b> Fraction of space Fraction of space Fraction of come Fraction of come Fraction of cotal Fraction of total Fraction of total Fractor for contre Factor for contre	equirement 921.68 equirement e heat from e heat from munity hea I space heat I space heat ol and charging method	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging methor (Table 4c(3	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild d (Table 4ci )) for com	((97)m - (9) 340.45 cheme ntary system ntary system ers (3)) for com nunity wate	1164.42 5)m] x (41) 170.50 n (table 11 munity sp er heating	789.51 m 0.00	0.00		<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.70 0.30 1.00	] (98)
Space heating re <b>9b. Energy req</b> Fraction of space Fraction of space Fraction of come Fraction of come Fraction of cotal Fraction of total Fraction of total Fractor for contre Factor for contre	equirement 921.68 equirement e heat from e heat from munity hea I space heat I space heat ol and charging method	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging methor (Table 4c(3	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild d (Table 4ci )) for com	((97)m - (9) 340.45 cheme ntary system ntary system ers (3)) for com nunity wate	1164.42 5)m] x (41) 170.50 n (table 11 munity sp er heating	789.51 m 0.00	0.00		<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.30 1.00 1.00	(98) (99) (301 (302 (303) (304) (304) (304) (304) (305)
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of come Fraction of come Fraction of total Fraction of total Fractor for contre Factor for charg Distribution loss	equirement 921.68 equirement e heat from e heat from munity hea I space heat I space heat ol and charging method	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging methor (Table 4c(3	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild d (Table 4ci )) for com	((97)m - (9) 340.45 cheme ntary system ntary system ers (3)) for com nunity wate	1164.42 5)m] x (41) 170.50 n (table 11 munity sp er heating	789.51 m 0.00	0.00		<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.30 1.00 1.00	(98) (99) (301 (302 (303) (304) (304) (304) (304) (305)
Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of come Fraction of come Fraction of cotal Fraction of total Fractor for contre Factor for charg Distribution loss Space heating	equirement 921.68 equirement uirements e heat from e heat from munity hea space heat l space heat ol and char ing method s factor (Tat	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging methoo (Table 4c(3 ile 12c) for e	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild d (Table 4ci )) for com	((97)m - (9) 340.45 cheme ntary system ntary system ers (3)) for com nunity wate	1164.42 5)m] x (41) 170.50 n (table 11 munity sp er heating	789.51 m 0.00	0.00	0.00	<u>0.00</u> Σ(9)	377.85 8)15, 10 (98) '0' if 1 - (3 (302) x (30	670.93 .12 = 4 ÷ (4) (4) (1) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.30 1.00 1.00	] (98) ] (99) ] (301 ] (302 ] (303 ] (304 ] (304 ] (305 ] (306
Space heating re Space heating re 9b. Energy req Fraction of space Fraction of space Fraction of com Fraction of total Fraction of total Fractor for contro Factor for charg Distribution loss Space heating Annual space heat from	equirement 921.68 equirement uirements e heat from munity hea munity hea l space heat l space heat ol and charg ing method s factor (Tat	kWh/mon 717.18 kWh/m²/ye communit secondary, communit t from boile t from CHP from comm from comm ging methoo (Table 4c(3 ile 12c) for e	th 0.024 x 591.06 ear y heating s /suppleme y system rs hunity CHP hunity boild d (Table 4ci )) for com	((97)m - (9) 340.45 cheme ntary system ntary system ers (3)) for com nunity wate	1164.42 5)m] x (41) 170.50 n (table 11 munity sp er heating	789.51 m 0.00	0.00	0.00	<u>0.00</u> Σ(9:	377.85 315, 10 (98) '0' if 1 - (3) (302) × (30) (302) × (30)	670.93 .12 = 4 ÷ (4) (4) (4) (4) (4) (5) (5) (5) (5) (5) (5) (5) (5) (5) (5	941.31 4730.96 42.61 0.00 1.00 0.30 0.70 0.30 1.00 1.00	(98) (99) (301 (302 (303) (304) (304) (304) (304) (305)

#### 1904.22 (64) Annual water heating requirement Water heat from CHP (64) x (303a) x (305a) x (306) = 1399.60 (310a) Water heat from boilers (64) x (303b) x (305a) x (306) = 599.83 (310b) Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 69.67 (313) Electricity for pumps, fans and electric keep-hot (Table 4f) mechanical ventilation fans - balanced, extract or positive input from outside 208.85 (330a) 208.85 (331) Total electricity for the above, kWh/year Electricity for lighting (Appendix L) 429.86 (332) Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) = 7605.65 (338) 10b. Fuel costs - community heating scheme Fuel Fuel price Fuel kWh/year cost £/year Space heating from CHP 3477.25 2.97 x 0.01 = 103.27 (340a) Space heating from boilers 1490.25 4.24 x 0.01 = 63.19 (340b) х Water heating from CHP 1399.60 2.97 x 0.01 = 41.57 (342a) x 599.83 4.24 x 0.01 = 25.43 (342b) Water heating from boilers х Pumps and fans 208.85 13.19 x 0.01 = 27.55 (349) х Electricity for lighting 429.86 13.19 x 0.01 = (350) 56.70 Additional standing charges 120.00 (351) (340a)...(342e) + (345)...(354) = (355) Total energy cost 437.71 11b. SAP rating - community heating scheme (356) Energy cost deflator (Table 12) 0.42 Energy cost factor (ECF) 1.18 (357) SAP value 83.56 SAP rating (section 13) 84 (358) SAP band В 12b. CO<sub>2</sub> emissions - community heating scheme Energy Emission factor Emissions kWh/year (kg/year) Emissions from community CHP (space and water heating) (361) Power efficiency of CHP unit 31.50

Heat efficiency of CHP unit		48.50					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	7169.0134	х	0.2160	=	1548.5069	(363)
less credit emissions for ele	ectricity	-2257.9570	х	0.5190	=	-1171.8797	(364)
Water heated by CHP		2885.5458	х	0.2160	=	623.2779	(365)
less credit emissions for ele	ectricity	-908.8333	х	0.5190	=	-471.6845	(366)
Emissions from other sources (	(space heating)						
Efficiency of boilers		91.80					(367b)
CO2 emissions from boilers	[(307b)+(310b)] x 100 ÷ (367b) =	2276.78	х	0.216	=	491.78	(368)
Electrical energy for communit	ty heat distribution	69.67	х	0.519	=	36.16	(372)
Total CO2 associated with com	imunity systems					1056.16	(373)
Total CO2 associated with space	ce and water heating					1056.16	(376)
Pumps and fans		208.85	х	0.519	=	108.39	(378)
Electricity for lighting		429.86	х	0.519	=	223.10	(379)

Page 5

SAP version 9.92

URN: WPB1-A1 version 15 NHER Plan Assessor version 6.3.4 SAP version 9.92 Water heating

Total CO <sub>2</sub> , kg/year	(376)(382) = 1387.65 (383	3)
Dwelling CO <sub>2</sub> emission rate	(383) ÷ (4) = 12.50 (384	4)
El value	88.08	
El rating (section 14)	88 (38	5)
El band	В	
El rating (section 14)	88 (38	5)

### 13b. Primary energy - community heating scheme

Energy kWh/year	Primary factor	Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)		
Power efficiency of CHP unit 31.50		(361)
Heat efficiency of CHP unit 48.50		(362)
Space heating from CHP $(307a) \times 100 \div (362) =$ 7169.01         x	1.22 =	8746.20 (363)
less credit energy for electricity -2257.96 x	3.07 =	-6931.93 (364)
Water heated by CHP 2885.55 x	1.22 =	3520.37 (365)
less credit energy for electricity -908.83 x	3.07 =	-2790.12 (366)
Primary energy from other sources (space heating)		
Efficiency of boilers 91.80		(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) = 2276.78 x	1.22 =	2777.67 ( <mark>368)</mark>
Electrical energy for community heat distribution 69.67 x	3.07 =	213.89 (372)
Total primary energy associated with community systems		5536.07 (373)
Total primary energy associated with space and water heating		5536.07 ( <mark>376)</mark>
Pumps and fans 208.85 x	3.07 =	641.15 ( <mark>378</mark> )
Electricity for lighting 429.86 x	3.07 =	1319.68 ( <mark>379)</mark>
Primary energy kWh/year		7496.90 (383)
Dwelling primary energy rate kWh/m2/year		67.52 (384)

### BRUKL Output Document HM Government

Compliance with England Building Regulations Part L 2013

### Project name

### Notting Hill Gate Office - Be Clean

As designed

Date: Mon May 21 12:16:36 2018

### Administrative information

Building	Details
Address:	Address 1, City, Postcode

### **Certification tool**

Calculation engine: Apache Calculation engine version: 7.0.6 Interface to calculation engine: IES Virtual Environment Interface to calculation engine version: 7.0.6 BRUKL compliance check version: v5.2.g.3

**Owner Details** Name: Name Telephone number: Phone Address: Street Address, City, Postcode

**Certifier details** Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO<sub>2</sub> emission rate for the building should not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	21.5
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	21.5
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	14.2
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	Ua-Limit		Ui-Calc	Surface where the maximum value occurs*			
Wall**	0.35	0.25	0.25	1F000000:Surf[1]			
Floor	0.25	0.16	0.16	1F000000:Surf[0]			
Roof	0.25	0.16	0.16	2F000001:Surf[0]			
Windows***, roof windows, and rooflights	2.2	1.1	1.1	1F000000:Surf[2]			
Personnel doors	2.2	-	-	No Personnel doors in building			
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building			
High usage entrance doors	3.5	-	-	No High usage entrance doors in building			
Us-Limit = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] Us-cate = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] Us-cate = Calculated maximum individual element U-values [W/(m <sup>2</sup> 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
m³/(h.m²) at 50 Pa	10	3

URN: WPB1-A1 version 15 NHER Plan Assessor version 6.3.4 SAP version 9.92

#### **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					
Whole building electric power factor achieved by power factor correction	0.9 to 0.95				

1- FCU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	0.96	4.5	0	1.6	0.75
Standard value	0.91*	3.2	N/A	1.6^	0.5

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES
\* Standard shown is for gas single boiler systems <= 2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting
efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

<sup>a</sup> Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

#### 1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	105	0.34
Standard value	105	0.2

#### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide								
Α	Local supply or extract ventilation units serving a single area								
В	Zonal supply system where the fan is remote from the zone								
С	Zonal extract system where the fan is remote from the zone								
D	D Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery								
Е	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								
н	Fan coil units								
1	Zonal extract system where the fan is remote from the zone with grease filter								

Zone name ID of system type		SFP [W/(I/s)]								HR efficiency	
		в	С	D	Е	F	G	н	1	пке	mciency
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Office Reception W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A

Zone name ID of system type		SFP [W/(I/s)]									
		в	С	D	E	F	G	н	I	HRE	efficiency
Standard value		1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
2F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
1F - Office W	100	-	-	1562
2F - Office W	100	-	-	1562
3F - Office W	100	-	-	1562
GF - Office Circulation	-	100	-	91
GF - Office Reception W	-	100	70	741
1F - Office Circulation W	-	100	-	52
1F - Office W	100	-	-	1025
1F - Office Circulation	-	100	-	50
1F - Office W	100	-	-	418
1F - Office Circulation W	-	100	-	30
1F - Office Circulation	-	100	-	125
1F - Office	100	-	-	284
2F - Office Circulation W	-	100	-	52
2F - Office Circulation W	-	100	-	30
2F - Office Circulation	-	100	-	125
2F - Office	100	-	-	284
2F - Office W	100	-	-	1025
2F - Office W	100	-	-	418
2F - Office Circulation	-	100	-	50
3F - Office Circulation W	-	100	-	52
3F - Office Circulation W	-	100	-	30
3F - Office Circulation	-	100	-	125
3F - Office	100	-	-	284
3F - Office W	100	-	-	1025
3F - Office W	100	-	-	418

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
3F - Office Circulation	-	100	-	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?
1F - Office W	NO (-63.9%)	YES
2F - Office W	NO (-56.7%)	YES
3F - Office W	NO (-60.7%)	YES
GF - Office Circulation	NO (-93.1%)	NO
GF - Office Reception W	NO (-22.3%)	YES
1F - Office Circulation W	NO (-58.2%)	YES
1F - Office W	NO (-56.8%)	YES
1F - Office Circulation	NO (-97.3%)	NO
1F - Office W	NO (-57.7%)	YES
1F - Office Circulation W	NO (-37.3%)	YES
1F - Office Circulation	NO (-98.2%)	NO
1F - Office	NO (-98.8%)	NO
2F - Office Circulation W	NO (-58.2%)	YES
2F - Office Circulation W	NO (-37.4%)	YES
2F - Office Circulation	NO (-98.1%)	NO
2F - Office	NO (-98.8%)	NO
2F - Office W	NO (-53.6%)	YES
2F - Office W	NO (-57.5%)	YES
2F - Office Circulation	NO (-97.2%)	NO
3F - Office Circulation W	NO (-58.1%)	YES
3F - Office Circulation W	NO (-36.4%)	YES
3F - Office Circulation	NO (-98%)	NO
3F - Office	NO (-98.7%)	NO
3F - Office W	NO (-51.5%)	YES
3F - Office W	NO (-56.7%)	YES
3F - Office Circulation	NO (-97.2%)	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?				
Is evidence of such assessment available as a separate submission?	YES			
Are any such measures included in the proposed design?	YES			

## Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters					
Actual	Notional	% Are			
2367.6	2367.6				
2554.6	2554.6				
LON	LON	100			
3	3	-			
1320.6	1374.19	-			
0.52	0.54	-			
10	10	_			
	Actual 2367.6 2554.6 LON 3 1320.6 0.52	Actual         Notional           2367.6         2367.6           2554.6         2554.6           LON         LON           3         3           1320.6         1374.19           0.52         0.54			

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

ldi	ng Use
ea	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
	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

ŀ	HVAC Systems Performance									
Sve	stem Type	Heat dem	Cool dem	Heat con	Cool con	Aux con	Heat	Cool	Heat gen	Cool gen
Uy.	stem type	MJ/m2	MJ/m2	kWh/m2	kWh/m2	kWh/m2	SSEEF	SSEER	SEFF	SEER
[ST	[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	47.8	40.6	15.3	2.6	11.3	0.87	4.34	0.96	5.5
	Notional	40.9	69.1	13.2	5.1	15.6	0.86	3.79		

Rey 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 to terms

### Energy Consumption by End Use [kWh/m<sup>2</sup>]

	Actual	Notional
Heating	15.34	13.19
Cooling	2.6	5.06
Auxiliary	11.92	15.62
Lighting	5.85	15.18
Hot water	10.81	2.2
Equipment*	31.57	31.57
TOTAL**	42.81	51.26

\* 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/m<sup>2</sup>]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.71	0
Solar thermal systems	0	0

### Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	88.47	110.01
Primary energy* [kWh/m <sup>2</sup> ]	82.43	126.14
Total emissions [kg/m²]	14.2	21.5

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

### **Key Features**

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

#### **Building fabric**

Element	U <sub>i-Typ</sub>	Ui-Min	Surface where the minimum value occurs*
Wall	0.23	0.25	1F000000:Surf[1]
Floor	0.2	0.16	1F000000:Surf[0]
Roof	0.15	0.16	2F000001:Surf[0]
Windows, roof windows, and rooflights	1.5	1.1	1F000000:Surf[2]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	15	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
Ui-Typ = Typical individual element U-values [W/(m <sup>2</sup> K)]			Ui-Min = Minimum individual element U-values [W/(m <sup>2</sup> K)]
* There might be more than one surface where the r	ninimum U	J-value oc	curs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

## BRUKL Output Document

Compliance with England Building Regulations Part L 2013

Project name

### Notting Hill Gate Retail - Be Clean

As designed

HM Government

Date: Fri May 18 10:05:59 2018

### Administrative information

Building Details	
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Address:	Notthing Hill	Gate,	London,	Postcode

### Certification tool

Calculation engine: Apache Calculation engine version: 7.0.6 Interface to calculation engine: IES Virtual Environment Interface to calculation engine version: 7.0.6 BRUKL compliance check version: v5.2.g.3 Owner Details Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO<sub>2</sub> emission rate for the building should not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	56.1
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	56.1
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	43.3
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 <sub>a-Limit</sub>	Ua-Calc		Surface where the maximum value occurs*
Wall**	0.35	0.25	0.25	GF000002:Surf[3]
Floor	0.25	0.16	0.16	GF000002:Surf[0]
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.1	1.1	GF000002:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building
Ua-Limit = Limiting area-weighted average U-values [V Ua-Cale = Calculated area-weighted average U-values		Ui-Calc = C	Calculated maximum individual element U-values [W/(m²K)]	

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	3

#### **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			
Whole building electric power factor achieved by power factor correction	0.9 to 0.95		

1- FCU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	0.96	4.5	0	1.6	0.75
Standard value	0.91*	0.7	N/A	1.6^	0.5

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES
\* Standard shown is for gas single boiler systems <- 2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting
efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

<sup>A</sup> Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

#### 1- CHECK2-CHP

CHPQA quality index This building 105		CHP electrical efficiency
This building	105	0.34
Standard value	105	0.2

#### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide						
Α	Local supply or extract ventilation units serving a single area						
В	Zonal supply system where the fan is remote from the zone						
С	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						
Е	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						
н	Fan coil units						
I.	Zonal extract system where the fan is remote from the zone with grease filter						
-							
∠on	ne name	SFP [W/(I/s)]					

Zone name			SFP [WV/(I/S)]								HR efficiency	
	ID of system type	Α	в	С	D	E	F	G	н	1	HK efficiency	
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
GF - Retail		-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Retail		-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Retail		-	-	-	-	-	-	-	0.2	-	-	N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
GF - Retail	-	100	70	723
GF - Retail	-	100	70	818
GF - Retail	-	100	70	766

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?
GF - Retail	YES (+12%)	NO
GF - Retail	NO (-46.6%)	NO
GF - Retail	NO (-43.2%)	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?			
Is evidence of such assessment available as a separate submission?			
Are any such measures included in the proposed design?	YES		

## Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters				
	Actual	Notional	% Are	
Area [m²]	151.7	151.7	100	
External area [m²]	567.9	567.9		
Weather	LON	LON		
Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa]	3	3		
Average conductance [W/K]	318.43	246.13		
Average U-value [W/m <sup>2</sup> K]	0.56	0.43		
Alpha value* [%]	10	10		

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

ld	ding Use				
ea	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				
	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/m<sup>2</sup>]

	Actual	Notional
Heating	74.96	44.55
Cooling	6.19	7.22
Auxiliary	26.91	21.46
Lighting	18.96	62.36
Hot water	38.59	1.86
Equipment*	20.26	20.26
TOTAL**	152.37	137.46

\* 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/m<sup>2</sup>]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	13.24	0
Solar thermal systems	0	0

### Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	327.96	236.81
Primary energy* [kWh/m <sup>2</sup> ]	249.16	329.15
Total emissions [kg/m <sup>2</sup> ]	43.3	56.1

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

H	HVAC Systems Performance									
Sys	stem Type	Heat 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	[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	233.8	94.2	75	6.2	16.5	0.87	4.34	0.96	5.5
	Notional	138.3	98.5	44.6	7.2	21.5	0.86	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

	1	T	1	
Element	U <sub>i-Typ</sub>	U <sub>i-Min</sub>	Surface where the minimum value occurs*	
Wall	0.23	0.25	GF000002:Surf[3]	
Floor	0.2	0.16	GF000002:Surf[0]	
Roof	0.15	-	UNKNOWN	
Windows, roof windows, and rooflights	1.5	1.1	GF000002:Surf[1]	
Personnel doors	1.5	-	No Personnel doors in building	
Vehicle access & similar large doors	15	-	No Vehicle access doors in building	
High usage entrance doors	1.5	-	No High usage entrance doors in building	
Ui-Typ = Typical individual element U-values [W/(m <sup>2</sup> K)] Ui-Min = Minimum individual element U-values			Ui-Min = Minimum individual element U-values [W/(m <sup>2</sup> K)]	
* 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	3	

APPENDIX 6 - SAMPLE 'BE GREEN' DER WORKSHEETS & BRUKL DOCUMENT

hoare lea (H.)

Project	Newcombe House - CB (GREEN)
Revision	2
Version	3
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
CB-A1	164.79	1	15.66	8.80	-43.79%	58.90	54.40	-7.65%	1.5	Medium
CB-A17 Duplex	333.64	1	14.86	8.00	-46.19%	64.95	61.11	-5.91%	1.9	Medium
CB-A2	162.36	1	16.50	9.85	-40.31%	62.82	59.04	-6.02%	1.4	Medium
CB-A20 Duplex	365.9	1	13.92	7.33	-47.35%	60.95	56.66	-7.03%	1.9	Medium
CB-A21 Duplex	367.27	1	19.28	11.25	-41.64%	88.15	85.58	-2.92%	2.4	Medium
CB-A3	164.79	2	13.28	6.98	-47.49%	47.03	42.64	-9.35%	1.8	Medium
CB-A4	162.81	2	14.22	8.15	-42.69%	51.49	48.22	-6.35%	1.9	Medium
CB-A7	165.65	5	13.45	7.06	-47.51%	48.12	43.51	-9.59%	1.9	Medium
CB-A8	162.21	7	14.58	8.37	-42.60%	53.32	49.72	-6.75%	1.9	Medium
Area Weighted Results	4012.88	21	14.73	8.18	-44.44%	57.05	53.17	-6.80%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m <sup>2</sup> K)	0.25	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
	Roof U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	(or value includes glass and marie)
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	Liphorpour of Brazilio outching obcumP are
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m²K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m²K)	0.18	As Calculated by BS EN ISO 6946
Thermal Mass	Thermal Mass Parameter (Simple)	Low	Based on Construction of Walls, Floors, Roofs (including party and internal floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges
Air Permeability Air Permeability Rate (m3/hm2 at 50Pa)		3	As stated on a test certificate from a person registered by an authorised pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure te
			If a dwelling is not pressure tested the value used in the calculation is an ave of the tested dwellings of the same type plus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. Bf Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compone together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
	Category Boilers - Fraction of Heat (-)	Communal 0.3	As design specification
	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	Pre-insulated low temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
	Emitter	Underfloor (Screed)	
	Туре	From Main System	
	Cylinder in Dwelling	No	
	Plate Heat Exchanger	Yes	
	Volume (litres)	1	
Water Heating	Insulation Type	Spray Foam	
	Insulation Thickness (mm)	30	
	Waste Water Heat Recovery	No	
	Туре	PV Panels	
Renewables	Peak Power (kWp)	33	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C
	Orientation	South East	
	Tilt	Horizontal	
<b>C F</b>	Areas Cooled	All Living Spaces and Bedrooms	
	EER	4.5	
Cooling			
Cooling	Controls	Variable Speed Compressor	
	Controls Openable Windows	Variable Speed Compressor No	
Summertime Overheating	Controls	Variable Speed Compressor	

hoare lea (H.)

Project	Newcombe House - KCS1 (GREEN)
Revision	2
Version	3
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
KCS1-A1	175.68	1	15.16	7.99	-47.29%	57.80	51.95	-10.12%	1.8	Medium
KCS1-A10	42.3	1	21.78	13.79	-36.68%	58.86	66.26	12.57%	2.9	Medium
KCS1-A11	151	1	13.73	6.82	-50.33%	48.00	41.09	-14.40%	2.2	Medium
KCS1-A12	58.88	1	17.09	9.47	-44.59%	44.17	42.11	-4.66%	2.6	Medium
KCS1-A13	183.45	1	15.89	9.32	-41.33%	62.25	59.91	-3.76%	2	Medium
KCS1-A14	151	1	16.04	9.27	-42.16%	59.61	57.18	-4.08%	2.2	Medium
KCS1-A15	58.88	1	19.40	11.86	-38.87%	55.76	57.64	3.37%	2.2	Medium
KCS1-A2	42.3	1	21.78	12.68	-41.79%	58.86	62.44	6.09%	3	Medium
KCS1-A3	143.5	1	16.35	8.69	-46.82%	60.02	53.47	-10.91%	1.8	Medium
KCS1-A4	58.88	1	19.40	10.78	-44.44%	55.76	53.44	-4.16%	2.3	Medium
KCS1-A5	175.68	1	12.79	6.46	-49.53%	46.04	40.28	-12.51%	2.1	Medium
KCS1-A6	42.3	1	19.52	11.64	-40.40%	47.32	52.20	10.30%	3.3	Medium
KCS1-A7	143.5	1	14.00	7.12	-49.12%	48.26	41.87	-13.25%	2.1	Medium
KCS1-A8	58.88	1	17.09	9.47	-44.59%	44.17	42.11	-4.66%	2.6	Medium
KCS1-A9	183.45	1	13.48	6.87	-49.02%	50.16	43.90	-12.49%	2.1	Medium
Area Weighted Results	1669.68	15	15.64	8.55	-45.36%	53.54	49.66	-7.25%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
External Eabric	Roof U-Values (W/m²K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
Internal Walls	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
internal walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m²K)	0.18	As Calculated by BS EN ISO 6946
Thermal Mass	Thermal Mass Parameter (Simple)	Low	Based on Construction of Walls, Floors, Roofs (including party and internal v floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges
Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	As stated on a test certificate from a person registered by an authorised a pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure te if a dwelling is not pressure tested the value used in the calculation is an av of the tested dwelling of the same type plus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. BE Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compone together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside t insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	A 1
	Boilers - Fraction of Heat (-) Boilers - Efficiency (%)	0.3 91.8	As design specification As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	Pre-insulated low temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to	
	Controis	use, programmer and TRVs	
	Emitter		
	Emitter Type	use, programmer and TRVs Underfloor (Screed) From Main System	
	Emitter Type Cylinder in Dwelling	use, programmer and TRVs Underfloor (Screed)	
	Emitter Type Cylinder in Dwelling Plate Heat Exchanger	use, programmer and TRVs Underfloor (Screed) From Main System	
	Emitter Type Cylinder in Dwelling	use, programmer and TRVs Underfloor (Screed) From Main System	
Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger	use, programmer and TRVs Underfloor (Screed) From Main System	
Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres)	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1	
Water Heating	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (itres) Insulation Type Insulation Thickness (nm) Waste Water Heat Recovery	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No	
	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels	Dark monor under 1000/m <sup>2</sup> of addation of m <sup>2</sup> /m
Water Heating Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (nm) Waste Water Heat Recovery Type Paik Power (kWp)	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C
	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C
Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33	Private Units have Comfort Cooling
	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (ittres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation Tit	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East Horizontal All Living Spaces and	
Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (ltres) Insulation Type Insulation Thickness (mm) Usuate Water Heat Recovery Type Peak Power (kWp) Orientation Tit Areas Cooled	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East Horizontal All Living Spaces and Bedrooms	Private Units have Comfort Cooling
Renewables Cooling	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation Tit Areas Cooled EER Controls Openable Windows	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East Horizontal All Living Spaces and Bedrooms 4.5 Variable Speed Compressor No	Private Units have Comfort Cooling
Renewables	Emitter Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation Tilt Areas Cooled EER Controls	use, programmer and TRVs Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East Horizontal All Living Spaces and Bedrooms 4.5 Variable Speed Compressor	Private Units have Comfort Cooling

hoare lea (H.)

Project	Newcombe House - KCS2 (GREEN)
Revision	2
Version	3
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
KCS2-A1	110.05	1	16.35	8.93	-45.38%	54.74	51.32	-6.25%	2.4	Medium
KCS2-A2	50.2	1	19.84	10.86	-45.28%	53.83	51.63	-4.07%	2.3	Medium
KCS2-A3	140.6	1	16.03	8.39	-47.68%	58.21	50.77	-12.78%	1.7	Medium
KCS2-A4	110.05	1	14.11	7.24	-48.67%	43.46	40.48	-6.86%	2.7	Medium
KCS2-A5	50.2	1	17.51	9.05	-48.29%	42.13	40.25	-4.46%	2.6	Medium
KCS2-A6	140.6	1	13.73	6.54	-52.35%	46.61	39.06	-16.21%	2.0	Medium
KCS2-A7	110.05	1	17.19	10.02	-41.71%	59.07	59.43	0.61%	2.5	Medium
KCS2-A8	50.2	1	19.84	11.53	-41.86%	53.83	55.86	3.78%	2.2	Medium
KCS2-A9	140.6	1	16.60	9.29	-44.03%	61.20	57.43	-6.16%	1.8	Medium
Area Weighted Results	902.55	9	16.21	8.72	-46.24%	53.37	49.60	-7.07%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
E	Roof U-Values (W/m²K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	(
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Thermal Mass	Thermal Mass Parameter (Simple)	Low	Based on Construction of Walls, Floors, Roofs (including party and internal v floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges
Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	As stated on a test certificate from a person registered by an authorised a pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure te If a dwelling is not pressure tested the value used in the calculation is an ave
	Strategy	Balanced with Heat Recovery	of the tested dwellings of the same type plus 2.
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. BE Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compone together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside t insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	
	Boilers - Fraction of Heat (-)	0.3	As design specification
	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
	CHP - Heat to Power Ratio (-)	1.54	Heat Supplied / Power Supplied
Space Heating	Heat Distribution System	Pre-insulated low temperature, variable flow (1991 or later)	District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
	Emitter	Underfloor (Screed)	
	Туре	From Main System	
	Cylinder in Dwelling	No	
	Plate Heat Exchanger	Yes	
	Volume (litres)	1	
Water Heating	Insulation Type	Spray Foam	
	Insulation Thickness (mm)	30	
	Waste Water Heat Recovery	No	
	Type	PV Panels	
D 11	Peak Power (kWp)	33	Peak power under 1kW/m <sup>2</sup> of radiation at 25°C
Renewables	Orientation	South East	
	Tilt	Horizontal	
	Openable Windows	No	
Summertime Overheating	Mechanical Ventilation Required	Yes	
		Light-coloured curtain or	

hoare lea (H.)

Project	Newcombe House - WPB1 (GREEN)
Revision	2
Version	3
Date	22/05/2018

Dwelling Reference	Dwelling Area (m²)	No. of Dwelling Type	TER	DER	Criterion 1 DER/TER Variance	TFEE	DFEE	Criterion 1 DFEE/TFEE Variance	Criterion 3 Overheating Strategy	Criterion 3 Overheating Risk
WPB1-A1	111.03	1	18.66	10.54	-43.50%	66.59	62.91	-5.52%	1.8	Medium
WPB1-A2	103.55	1	18.58	10.46	-43.70%	64.98	61.44	-5.45%	1.8	Medium
WPB1-A3	95.21	1	18.94	10.80	-42.97%	64.73	61.71	-4.67%	1.9	Medium
WPB1-A4	112.47	1	18.63	10.55	-43.38%	66.72	62.97	-5.62%	1.8	Medium
Area Weighted Results	422.26	4	18.70	10.58	-43.39%	65.81	62.29	-5.34%		0

Category	Parameter	Value	Notes
	External Wall U-Values (W/m²K)	0.18	As Calculated by BS EN ISO 6946
	Floor U-Values (W/m <sup>2</sup> K)	0.09	As Calculated by BS EN ISO 6946
	Roof U-Values (W/m²K)	0.18	As Calculated by BS EN ISO 6946
External Fabric	Glazing U-Value (W/m2K)	1.10	As Calculated by BS EN ISO 12567 or 10077 (U-Value includes glass and frame)
	G-Value (-)	0.55	(o valae medaeo giass ana mane)
	Fraction Glazed (%)	0.80	Proportion of glass to overall opening size
	To Other Apartments	Fully Filled Cavity with Sealed Edges	
	To Corridors (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
Internal Walls	To Risers (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Lift Shafts (W/m <sup>2</sup> K)	0.18	As Calculated by BS EN ISO 6946
	To Stair Wells (W/m²K)	0.18	As Calculated by BS EN ISO 6946
Thermal Mass	Thermal Mass Parameter (Simple)	Low	Based on Construction of Walls, Floors, Roofs (including party and internal floors and ceilings)
Thermal Bridging	Thermal Bridge Specification	Default	No further information required on thermal bridges
Air Permeability	Air Permeability Rate (m3/hm2 at 50Pa)	3	As stated on a test certificate from a person registered by an authorised pressure testing scheme Note to use the measured air perm rate each dwelling has to be pressure te If a dwelling is not pressure tested the value used in the calculation is an avoid of the tested dwellings of the same type pus 2.
	Strategy	Balanced with Heat Recovery	
	SFP (W/I/s)	0.52 (K+1), 0.55 (K+2), 63 (K+3), 74 (K+4), 86 (K+5)	SAP Appendix Q Test Results
	Heat Exchange Efficiency (%)	92 (K+1), 92 (K+2), 90 (K+3), 89 (K+4), 89 (K+5)	SAP Appendix Q Test Results
Mechanical Ventilation	Installer approved	Yes	The installer has be registered with a Government Approved Scheme e.g. B Blue Flame Certification, Certsure, NAPIT and Stroma
	Duct Type	Rigid	All ductwork is rigid except for occasional flexible ducting to join compon together
	Ductwork Insulated	Yes	Ductwork can be assumed to be insulated if all of the ductwork is inside insulated envelope even if the ductwork itself is uninsulated.
	Category	Communal	
	Boilers - Fraction of Heat (-)	0.3	As design specification
	Boilers - Efficiency (%)	91.8	As calculated by SAP Appendix D
	CHP - Fraction of Heat (-)	0.7	As design specification
	CHP - Efficiency (%)	80	Gross Efficiency from Manufacturers Literature
Space Heating	CHP - Heat to Power Ratio (-) Heat Distribution System	1.54 Pre-insulated low temperature, variable flow (1991 or later)	Heat Supplied / Power Supplied District heating specification
	Controls	Charging system linked to use, programmer and TRVs	
·		use, programmer and rikvs	
	Emitter	Underfloor (Screed)	
	Emitter Type		
	Type Cylinder in Dwelling	Underfloor (Screed)	
	Type Cylinder in Dwelling Plate Heat Exchanger	Underfloor (Screed) From Main System	
	Type Cylinder in Dwelling	Underfloor (Screed) From Main System No	
Water Heating	Type Cylinder in Dwelling Plate Heat Exchanger	Underfloor (Screed) From Main System No	
Water Heating	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres)	Underfloor (Screed) From Main System No Yes 1	
Water Heating	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type	Underfloor (Screed) From Main System No Yes 1 Spray Foam	
Water Heating	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm)	Underfloor (Screed) From Main System No Yes 1 Spray Foam 30	
	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery	Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C
Water Heating Renewables	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation	Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C
	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation Tit	Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East Horizontal	Peak power under 1kW/m <sup>2</sup> of radiation at 25°C
	Type Cylinder in Dwelling Plate Heat Exchanger Volume (litres) Insulation Type Insulation Thickness (mm) Waste Water Heat Recovery Type Peak Power (kWp) Orientation	Underfloor (Screed) From Main System No Yes 1 Spray Foam 30 No PV Panels 33 South East	Peak power under 1kW/m <sup>2</sup> of radiation at 25 <sup>°</sup> C

## **DER Worksheet**

## Design - Draft



SAP version 9.92

Assessor name	Mr Liam Holden		Assessor number	10245
Client			Last modified	20/06/2018
Address	A1, London			
L. Overall dwelling dime	ensions			
		Area (m²)	Average storey height (m)	Volume (m³)
owest occupied		164.79 (1a) x	2.85 (2a) =	469.65 (3a)
otal floor area	(1a) + (1b) + (1c) + (1d)(1	1n) = 164.79 (4)		
welling volume			(3a) + (3b) + (3c) + (3d)(3	3n) = 469.65 (5)
2. Ventilation rate				
				m <sup>3</sup> per hour
lumber of chimneys			0 x 40 =	
Number of open flues			0 x 20 =	
Number of intermittent fa	ans		0 x 10 =	
Number of passive vents			0 x 10 =	
lumber of flueless gas fir	es		0 x 40 =	
				Air changes per hour
filtration due to chimne	eys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (	7c) = 0 ÷ (5) =	= 0.00 (8)
a pressurisation test ha	s been carried out or is intended, pr	oceed to (17), otherwise continue	e from (9) to (16)	
ir permeability value, q5	60, expressed in cubic metres per ho	our per square metre of envelope	e area	3.00 (17)
f based on air permeabili	ity value, then (18) = [(17) ÷ 20] + (8	3), otherwise (18) = (16)		0.15 (18)
lumber of sides on which	n the dwelling is sheltered			1 (19)
helter factor			1 - [0.075 x (1	9)] = 0.93 (20)
nfiltration rate incorpora	ting shelter factor		(18) x (2	20) = 0.14 (21)
nfiltration rate modified	for monthly wind speed:			
Jan	Feb Mar Apr	May Jun Jul	Aug Sep Oct	Nov Dec
Aonthly average wind sp				
5.10	5.00 4.90 4.40	4.30 3.80 3.80	3.70 4.00 4.30	4.50 4.70 (22)
Vind factor (22)m ÷ 4				
1.28	1.25 1.23 1.10	1.08 0.95 0.95	0.93 1.00 1.08	1.13 1.18 <mark>(22a)</mark>
	(allowing for shelter and wind facto		0.12 0.14 0.15	0.16 0.16 (22b)
0.18	0.17 0.17 0.15 onge rate for the applicable case:	0.15 0.13 0.13	0.13 0.14 0.15	0.16 0.16 (22b)
				(22-)
	on: air change rate through system			0.50 (23a)
	recovery: efficiency in % allowing fo			79.90 (23c)
	ical ventilation with heat recovery (			
0.28	0.27 0.27 0.25	0.25 0.23 0.23	0.23 0.24 0.25	0.26 0.26 (24a)
	enter (24a) or (24b) or (24c) or (24		0.22 0.24 0.25	
0.28	0.27 0.27 0.25	0.25 0.23 0.23	0.23 0.24 0.25	0.26 0.26 (25)
a the			NL	URN: CB-A1 version 16 ER Plan Assessor version 6.3.4
SAP		Page 1	Nn	SAP version 9.92

3. Heat losses	and heat loss pa	rameter									
Element			Gross area, m <sup>2</sup>	Openings m <sup>2</sup>	s Net A,		U-value W/m²K	A x U W	/К к-value, kJ/m².K	Ахк, kJ/K	
Window					43.	.25 x	1.05	= 45.57			(27)
Ground floor					164	.79 x	0.09	= 14.83			(28a)
External wall					95.	.46 x	0.25	= 23.87			(29a)
External wall					30	.12 x	0.18	= 5.42			(29a)
Party wall					9.	58 x	0.00	= 0.00			(32)
Total area of ex	ternal elements 3	A, m²			333	.62					(31)
Fabric heat loss,	, W/K = ∑(A × U)							(26	i)(30) + (32) =	89.69	(33)
Heat capacity C	m = ∑(А x к)						(28)	.(30) + (32) +	- (32a)(32e) =	N/A	(34)
Thermal mass p	arameter (TMP) i	in kJ/m²K								100.00	(35)
Thermal bridges	s: ∑(L x Ψ) calcula	ted using App	endix K							50.04	(36)
Total fabric hear	t loss								(33) + (36) =	139.73	(37)
	Jan F	eb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct No	ov Dec	
Ventilation heat	t loss calculated r	nonthly 0.33	x (25)m x (5)								
	42.99 42	.46 41.9	39.23	38.69	36.00	36.00	35.47	37.08	38.69 39	77 40.84	(38)
Heat transfer co	oefficient, W/K (3	37)m + (38)m									
	182.72 182	2.19 181.6	5 178.96	178.42	175.74	175.74	175.20	176.81	178.42 179	.50 180.57	
								Average = ∑	(39)112/12 =	178.83	(39)
Heat loss param	neter (HLP), W/m	²K (39)m÷(4	)								
	1.11 1.	.11 1.10	1.09	1.08	1.07	1.07	1.06	1.07	1.08 1.	09 1.10	
								Average = ∑	(40)112/12 =	1.09	(40)
Number of days	in month (Table	1a)									
	31.00 28	.00 31.0	30.00	31.00	30.00	31.00	31.00	30.00	31.00 30	00 31.00	(40)
4. Water heati	ng energy requir	ement									
Assumed occup										2.96	(42)
	hot water usage	in litres per d	ay Vd,average	e = (25 x N) +	- 36					104.39	(43)
		eb Mar		May	Jun	Jul	Aug	Sep	Oct No		
Hot water usage	e in litres per day	for each mor	th Vd,m = fac	tor from Tab	ole 1c x (43	)					
		0.66 106.4		98.13	93.95	93.95	98.13	102.31	106.48 110	.66 114.83	7
							1		∑(44)112 =	1252.73	(44)
Energy content	of hot water use	d = 4.18 x Vd,	m x nm x Tm/3	3600 kWh/m	nonth (see	Tables 1b	, 1c 1d)		2. ,		
	170.29 14	8.94 153.6	9 133.99	128.57	110.95	102.81	117.97	119.38	139.13 151	.87 164.92	7
									∑(45)112 =	1642.52	(45)
Distribution loss	s 0.15 x (45)m										_
	25.54 22	.34 23.0	5 20.10	19.29	16.64	15.42	17.70	17.91	20.87 22	78 24.74	(46)
Storage volume	(litres) including	any solar or \	VWHRS storag	ge within sar	ne vessel		•			1.00	(47)
Water storage l	OSS:										
b) Manufacture	r's declared loss f	factor is not k	nown								
Hot water st	orage loss factor	from Table 2	(kWh/litre/da	y)						0.02	(51)
Volume facto	or from Table 2a									4.93	(52)
Temperature	e factor from Tab	le 2b								1.00	(53)
	rom water storag		(47) x (51) x (	52) x (53)						0.10	(54)
Enter (50) or (54				,						0.10	(55)
	oss calculated for	each month	(55) x (41)m								
-		.92 3.24		3.24	3.13	3.24	3.24	3.13	3.24 3.	13 3.24	(56)

URN: CB-A1 version 16 NHER Plan Assessor version 6.3.4 SAP version 9.92

Page 2

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] $\div$ (47), else (56)	Temperature during heating periods in the living area from Table 9, Th1(°C) (85)
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Primary circuit loss for each month from Table 3	Utilisation factor for gains for living area n1,m (see Table 9a)
23.26         21.01         23.26         22.51         23.26         22.51         23.26         23.26         22.51         23.26         25.51         23.26         25.51 <th< td=""><td>0.97 0.95 0.90 0.81 0.69 0.54 0.41 0.46 0.67 0.87 0.95 0.98 (86)</td></th<>	0.97 0.95 0.90 0.81 0.69 0.54 0.41 0.46 0.67 0.87 0.95 0.98 (86)
Combi loss for each month from Table 3a, 3b or 3c	Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)	18.61 19.00 19.52 20.12 20.57 20.85 20.95 20.93 20.72 20.08 19.23 18.55 (87)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)
196.79 172.88 180.19 159.64 155.07 136.59 129.31 144.47 145.03 165.63 177.52 191.42 (62)	19.99         20.00         20.01         20.01         20.03         20.03         20.02         20.01         20.00         (88)
Solar DHW input calculated using Appendix G or Appendix H	Utilisation factor for gains for rest of dwelling n2,m
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)	0.97 0.94 0.88 0.79 0.65 0.48 0.33 0.38 0.61 0.84 0.95 0.97 (89)
Output from water heater for each month (kWh/month) (62)m + (63)m	Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)
196.79 172.88 180.19 159.64 155.07 136.59 129.31 144.47 145.03 165.63 177.52 191.42	16.79         17.35         18.10         18.94         19.54         19.89         19.99         19.98         19.74         18.90         17.69         16.70         (90)
$\Sigma(64)112 = 1954.54$ (64)	Living area fraction Living area $\div$ (4) = 0.52 (91)
Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]	Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2
77.82 68.67 72.30 65.07 63.95 57.41 55.38 60.43 60.21 67.46 71.01 76.04 (65)	17.73         18.20         18.83         19.55         20.07         20.38         20.47         20.25         19.51         18.48         17.65         (92)
<u>77.82</u> 08.07 72.30 03.07 03.53 37.41 35.36 00.43 00.21 07.40 71.01 70.04 (03)	Apply adjustment to the mean internal temperature from Table 4e where appropriate
5. Internal gains	17.73         18.20         18.83         19.55         20.07         20.38         20.47         20.25         19.51         18.48         17.65         (93)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Metabolic gains (Table 5)	8. Space heating requirement
147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 147.78 (66)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	Utilisation factor for gains, ŋm
29.97 26.62 21.65 16.39 12.25 10.34 11.18 14.53 19.50 24.76 28.90 30.81 (67)	0.95 0.92 0.86 0.77 0.65 0.50 0.37 0.41 0.62 0.83 0.93 0.96 (94)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	Useful gains, ŋmGm, W  (94)m x (84)m
336.20         339.69         330.89         312.18         288.55         266.35         251.52         248.03         256.82         275.53         299.16         321.36         (68)	864.90 1085.31 1244.65 1305.22 1199.41 914.16 649.87 668.22 897.92 978.85 872.35 802.63 (95)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	Monthly average external temperature from Table U1
37.78         37.78 <th< td=""><td>4.30         4.90         6.50         8.90         11.70         14.60         16.60         16.40         14.10         10.60         7.10         4.20         (96)</td></th<>	4.30         4.90         6.50         8.90         11.70         14.60         16.60         16.40         14.10         10.60         7.10         4.20         (96)
Pump and fan gains (Table 5a)	Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)	2453.60 2422.80 2240.29 1905.95 1494.28 1016.32 682.55 712.76 1086.51 1589.86 2043.28 2429.30 (97)
Losses e.g. evaporation (Table 5)	Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m
-118.22 -118.22	1182.00         898.80         740.76         432.53         219.38         0.00         0.00         0.00         454.59         843.07         1210.24
Water heating gains (Table 5)	Σ(98)15, 1012 = <b>5981.35</b> (98)
104.60         102.19         97.18         90.37         85.95         79.73         74.44         81.22         83.63         90.67         98.63         102.20         (72)	Space heating requirement kWh/m <sup>2</sup> /year (98) ÷ (4) 36.30 (99)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	
538.10 535.83 517.06 486.28 454.09 423.76 404.47 411.11 427.28 458.30 494.02 521.70 (73)	8c. Space cooling requirement
	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
6. Solar gains	Heat loss rate Lm
Access factor Area Solar flux g FF Gains Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W	0.00 0.00 0.00 0.00 0.00 1651.91 1300.44 1331.50 0.00 0.00 0.00 (100)
or Table 6b or Table 6c	Utilisation factor for loss nm
North 0.77 x 9.09 x 10.63 x 0.9 x 0.55 x 0.80 = 29.47 (74)	0.00 0.00 0.00 0.00 0.00 0.83 0.88 0.86 0.00 0.00 0.00 (101)
East 0.77 x 15.15 x 19.64 x 0.9 x 0.55 x 0.80 = 90.73 (76)	Useful loss ηmLm (watts) (100)m x (101)m
South 0.77 x 16.18 x 46.75 x 0.9 x 0.55 x 0.80 = 230.66 (78)	0.00 0.00 0.00 0.00 0.00 1377.96 1149.02 1145.93 0.00 0.00 0.00 0.00 (102)
West 0.77 x 2.83 x 19.64 x 0.9 x 0.55 x 0.80 = 16.95 (80)	Gains
Solar gains in watts ∑(74)m(82)m	0.00 0.00 0.00 0.00 0.00 2256.40 2163.65 2006.03 0.00 0.00 0.00 (103)
367.81 644.72 923.79 1203.51 1393.85 1401.80 1344.14 1200.78 1021.19 724.43 444.03 312.43 (83)	Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m
Total gains - internal and solar (73)m + (83)m	0.00 0.00 0.00 0.00 0.00 632.48 754.88 639.92 0.00 0.00 0.00 0.00
905.91 1180.55 1440.85 1689.78 1847.94 1825.56 1748.60 1611.89 1448.46 1182.73 938.04 834.13 (84)	$\Sigma(104)68 = 2027.28$ (104)
	Cooled fractioncooled area $\div$ (4) = (105)Intermitting of factor (Table 10)
7. Mean internal temperature (heating season)	Intermittency factor (Table 10)
URN: CB-A1 version 16	URN: CB-A1 version 16
NHER Plan Assessor version 6.3.4	NHER Plan Assessor version 6.3.4
Page 3 SAP version 9.92	Page 4 SAP version 9.92

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	1
0.00	0.00	0.00	0.00	0.00	0.25	0.23	0.25	0.00	Σ(106)6.		0.75	(106)
Space cooling requirement (1	104)m x (1(	05) x (106)	m						2(100)0.		0.75	(100)
0.00	0.00	0.00	0.00	0.00	129.77	154.88	131.29	0.00	0.00	0.00	0.00	1
0.00	0.00	0.00	0.00	0.00	125177	10 1100	101.20	0.00	Σ(107)6.		415.94	(107)
Space cooling requirement k	Wh/m²/ve	ar							(107)÷		2.52	(108)
page cooming requirement in	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,								(107) 1	(.,	2.02	(100)
9b. Energy requirements - c	ommunity	y heating s	cheme									
Fraction of space heat from s	econdary/	'supplemer	ntary syste	m (table 11	.)				'0' if r	none	0.00	(301)
Fraction of space heat from c	community	/ system							1 - (30	)1) =	1.00	(302)
Fraction of community heat f	rom boiler	rs									0.30	(303a)
Fraction of community heat f	rom CHP										0.70	(303b)
Fraction of total space heat f	rom comm	nunity CHP							(302) x (303	3a) =	0.70	(304a)
Fraction of total space heat f	rom comm	unity boile	ers						(302) x (303	3b) = 🗌	0.30	(304b)
Factor for control and chargir	ng method	l (Table 4c(	3)) for com	munity sp	ace heating						1.00	(305)
Factor for charging method (	Table 4c(3)	)) for comr	nunity wat	er heating							1.00	(305a)
Distribution loss factor (Table	e 12c) for c	ommunity	heating sy	stem							1.05	(306)
Space heating												
Annual space heating require	ement						5	981.35	]			(98)
Space heat from CHP							(98	3) x (304a) x	(305) x (30	06) =	4396.29	(307a)
Space heat from boilers							(98	8) x (304b) x	(305) x (30	06) =	1884.13	(307b)
Nater heating									1			
Annual water heating require	ement						1	954.54				(64)
Water heat from CHP							(64)	x (303a) x	(305a) x (30	06) =	1436.59	(310a)
Water heat from boilers							(64)	x (303b) x	(305a) x (30	06) =	615.68	(310b)
Electricity used for heat distri	ibution					0.01	× [(307a)	.(307e) + (3	10a)(310	e)] =	83.33	(313)
Cooling System Energy Efficie	nov Datio										6.08	(314)
Space cooling (if there is a fix		sustam if	not optor						(107) ÷ (	214)	68.47	(314)
Electricity for pumps, fans an				5)					(107)÷(	514)	08.47	] (313)
				input from	n outside			379.60	1			(330a)
mechanical ventilation far Total electricity for the above				: input iror	in outside			575.00	1		379.60	(330a)
		11									529.32	(331)
Electricity for lighting (Appen Energy saving/generation tec											525.32	_ (332)
electricity generated by P											-616.00	(333)
Total delivered energy for all				(3	307) + (309)	+ (310) + (	312) + (315	i) + (331) +	(332)(337	7b) =	8694.07	(338)
0,				14	, (200)	(- · <del>-</del> / (	, (	,,	,	, L		_ 、 /
10b. Fuel costs - community	y heating s	cheme										
				k\	Fuel Vh/year		Fu	el price		c	Fuel cost £/year	
Space heating from CHP					396.29	x		2.97	x 0.01	_	130.57	(340a)
Space heating from boilers				1	.884.13	x		4.24	x 0.01	= [	79.89	(340b)
Water heating from CHP				1	436.59	х		2.97	x 0.01	=	42.67	(342a)
					615.68	х		4.24	x 0.01	= [	26.10	(342b)
Water heating from boilers									1			-
Water heating from boilers Space cooling					68.47	х		13.19	x 0.01	=	9.03	(348)
-					68.47 379.60	x		13.19 13.19	x 0.01		9.03	(348)

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SAP version 9.92

Additional standing charges				120.00	(351)
Energy saving/generation technologies					-
pv savings	-616.00	x	13.19 x 0.01 =	0.00	(352)
Total energy cost			(340a)(342e) + (345)(354) =	528.15	(355)
11b. SAP rating - community heating scheme					
					1
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)				1.06	(357)
SAP value				85.25	]
SAP rating (section 13)				85	(358)
SAP band				В	]

	emissions - c		

	Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from community CHP (space and water heating)						
Power efficiency of CHP unit	31.50					(361)
Heat efficiency of CHP unit	48.50					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	9063.7862	x	0.2160	=	1957.7778	(363)
less credit emissions for electricity	-2854.7358	x	0.5190	=	-1481.6079	(364)
Water heated by CHP	2961.8001	x	0.2160	=	639.7488	(365)
less credit emissions for electricity	-932.8504	x	0.5190	=	-484.1494	(366)
Emissions from other sources (space heating)						
Efficiency of boilers	91.80					(367b)
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) =	2723.10	x	0.216	=	588.19	(368)
Electrical energy for community heat distribution	83.33	x	0.519	=	43.25	(372)
Total CO2 associated with community systems					1263.21	(373)
Total CO2 associated with space and water heating					1263.21	(376)
Space cooling	68.47	x	0.519	=	35.53	(377)
Pumps and fans	379.60	x	0.519	=	197.01	(378)
Electricity for lighting	529.32	x	0.519	=	274.72	(379)
Energy saving/generation technologies						
pv savings	-616.00	x	0.519	=	-319.70	(380)
Total CO <sub>2</sub> , kg/year				(376)(382) =	1450.76	(383)
Dwelling CO <sub>2</sub> emission rate				(383) ÷ (4) =	8.80	(384)
El value					90.73	]
El rating (section 14)					91	(385)
El band					В	]

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)		
Primary Energy from community CHP (s	pace and water heating)						
Power efficiency of CHP unit		31.50	]				(361)
Heat efficiency of CHP unit		48.50	]				(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	9063.79	x	1.22	=	11057.82	(363)
less credit energy for electricity		-2854.74	x	3.07	=	-8764.04	(364)
Water heated by CHP		2961.80	x	1.22	=	3613.40	(365)
less credit energy for electricity		-932.85	x	3.07	=	-2863.85	(366)

URN: CB-A1 version 16 NHER Plan Assessor version 6.3.4

Page 6

Primary energy from other sources (space heating)						
Efficiency of boilers	91.80					(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b)	= 2723.10	х	1.22	=	3322.18	(368)
Electrical energy for community heat distribution	83.33	х	3.07	=	255.81	(372)
Total primary energy associated with community systems					6621.32	(373)
Total primary energy associated with space and water heating					6621.32	(376)
Space cooling	68.47	х	3.07	=	210.19	(377)
Pumps and fans	379.60	х	3.07	=	1165.36	(378)
Electricity for lighting	529.32	х	3.07	=	1625.01	(379)
Energy saving/generation technologies						
Electricity generated - PVs	-616.00	х	3.07	=	-1891.12	(380)
Primary energy kWh/year					7730.77	(383)
Dwelling primary energy rate kWh/m2/year					46.91	(384)

## **DER Worksheet**



Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address	A1, London		

1. Overall dwelling dimensions					
		Area (m²)		Average storey height (m)	Volume (m³)
Lowest occupied		175.68 (1a)	x	2.70 (2a) =	474.34 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	175.68 (4)			
Dwelling volume				(3a) + (3b) + (3c) + (3d)(3n)	= 474.34 (5)

2. Ventilation rate

												m <sup>3</sup> per hour	
Number of chim	neys								0	x 40 =	- [	0	(6a)
Number of open	flues								0	] x 20 =	- [	0	(6b)
Number of inter	mittent fan	S							0	) x 10 =	- [	0	(7a)
Number of passi	ve vents								0	] x 10 =	- [	0	(7b)
Number of fluele	ess gas fires	5							0	] x 40 =	- [	0	(7c)
											1	Air changes po hour	er
Infiltration due t	o chimneys	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	] ÷ (5) =	- [	0.00	(8)
lf a pressurisatio	n test has l	been carried	d out or is i	ntended, pi	roceed to (1	17), otherw	ise continue	e from (9)	to (16)				
Air permeability	value, q50,	, expressed	in cubic m	etres per h	our per squ	are metre	of envelope	e area			[	3.00	(17)
If based on air p	ermeability	value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwis	se (18) = (16	5)					0.15	(18)
Number of sides	on which t	he dwelling	g is sheltere	ed							[	1	(19)
Shelter factor									1 -	[0.075 x (1	9)] =	0.93	(20)
Infiltration rate i	ncorporati	ng shelter f	actor							(18) x (2	20) = [	0.14	(21)
Infiltration rate	modified fo	r monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	No	v Dec	
Monthly average	e wind spee	ed from Tab	ole U2					_					_
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.5	0 4.70	(22)
Wind factor (22)	m ÷ 4												_
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.1	.3 1.18	(22a
Adjusted infiltra	tion rate (a	llowing for	shelter and	d wind facto	or) (21) x (2	2a)m							_
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.1	.6 0.16	(22t
Calculate effection	ve air chan	ge rate for	the applica	ble case:									
If mechanical	ventilation	n: air chang	e rate thro	ugh system								0.50	(23a
If balanced w	ith heat ree	covery: effi	ciency in %	allowing fo	or in-use fac	ctor from T	able 4h				[	79.90	(230
a) If balanced	l mechanica	al ventilatio	on with hea	t recovery	(MVHR) (22	2b)m + (23b	o) x [1 - (230	c) ÷ 100]					_
	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.2	6 0.26	(24a
Effective air chai	nge rate - e	nter (24a) o	or (24b) or	(24c) or (24	ld) in (25)								
	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.2	6 0.26	(25)

Page 1



URN: CB-A1 version 16 NHER Plan Assessor version 6.3.4 SAP version 9.92

3. Heat losses and heat loss parameter	Primary circuit loss for each month from Table 3
Element Gross Openings Net area U-value А x U W/К к-value, А x к,	23.26         21.01         23.26         22.51         23.26         22.51         23.26         23.26         22.51         23.26         23.26         22.51         23.26         23.26         22.51         23.26 <th< td=""></th<>
area, m <sup>2</sup> m <sup>2</sup> A, m <sup>2</sup> W/m <sup>2</sup> K kJ/m <sup>2</sup> .K kJ/K	Combi loss for each month from Table 3a, 3b or 3c
Window $50.94$ x $1.05$ = $53.67$ (27)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)
Ground floor 175.65 x 0.09 = 15.81 (28a)	Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m
External wall         126.94         x         0.18         =         22.85         (29a)	197.36         173.37         180.70         160.08         155.50         136.96         129.65         144.87         145.42         166.09         178.02         191.97         (62)
Total area of external elements $\Sigma A$ , m <sup>2</sup> 353.53 (31)	Solar DHW input calculated using Appendix G or Appendix H
Fabric heat loss, $W/K = \sum (A \times U)$ (26)(30) + (32) = 92.33 (33)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)
Heat capacity $Cm = \sum (A \times \kappa)$ (28)(30) + (32) + (32a)(32e) = N/A (34)	Output from water heater for each month (kWh/month) (62)m + (63)m
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K [100.00] (35)	197.36         173.37         180.70         160.08         155.50         136.96         129.65         144.87         145.42         166.09         178.02         191.97
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Appendix K 53.03 (36)	Σ(64)112 = <u>1960.00</u> (64)
Total fabric heat loss (33) + (36) = 145.36 (37)	Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	78.01 68.84 72.47 65.22 64.09 57.53 55.50 60.56 60.34 67.61 71.18 76.22 (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	
43.42         42.88         42.34         39.62         39.08         36.36         36.36         35.82         37.45         39.08         40.16         41.25         (38)	5. Internal gains
Heat transfer coefficient, W/K (37)m + (38)m	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
188.78         188.24         187.70         184.98         184.44         181.72         181.72         181.18         182.81         184.44         185.52         186.61	Metabolic gains (Table 5)
Average = $\sum(39)112/12 = 184.85$ (39)	148.51       148.51       148.51       148.51       148.51       148.51       148.51       148.51       148.51       148.51       148.51       148.51       166)
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
1.07         1.07         1.07         1.05         1.03         1.03         1.03         1.04         1.05         1.06         1.06	30.96         27.50         22.36         16.93         12.66         10.69         11.55         15.01         20.14         25.58         29.85         31.82         (67)
Average = $\Sigma(40)112/12 = 1.05$ (40)	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
Number of days in month (Table 1a)	347.30         350.90         341.82         322.49         298.08         275.14         259.82         256.22         265.30         284.63         309.04         331.98         (68)
31.00 28.00 31.00 30.00 31.00 30.00 31.00 31.00 30.00 31.00 30.00 31.00 (40)	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
	37.85         37.85
4. Water heating energy requirement	Pump and fan gains (Table 5a)
Assumed occupancy, N 2.97 (42)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)
Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 [104.74] (43)	Losses e.g. evaporation (Table 5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	-118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 -118.80 (71)
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	Water heating gains (Table 5)
115.21         111.02         106.84         102.65         98.46         94.27         94.27         98.46         102.65         106.84         111.02         115.21	104.85         102.43         97.41         90.58         86.14         79.90         74.59         81.39         83.81         90.88         98.86         102.44         (72)
$\Sigma(44)112 = 1256.89$ (44)	Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	550.67 548.39 529.15 497.55 464.44 433.28 413.51 420.17 436.80 468.64 505.30 533.79 (73)
170.86 149.44 154.20 134.44 129.00 111.31 103.15 118.37 119.78 139.59 152.37 165.47	6. Solar gains
$\Sigma(45)112 = 1647.98$ (45)	
Distribution loss 0.15 x (45)m	Access factor Area Solar flux g FF Gains Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W
25.63 22.42 23.13 20.17 19.35 16.70 15.47 17.75 17.97 20.94 22.86 24.82 (46)	or Table 6b or Table 6c
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00 (47)	East 0.77 x 20.62 x 19.64 x 0.9 x 0.55 x 0.80 = 123.49 (76)
Water storage loss:	South 0.77 x 11.45 x 46.75 x 0.9 x 0.55 x 0.80 = 163.23 (78)
b) Manufacturer's declared loss factor is not known	West 0.77 x 18.87 x 19.64 x 0.9 x 0.55 x 0.80 = 113.01 (80)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)	Solar gains in watts ∑(74)m(82)m
Volume factor from Table 2a 4.93 (52)	399.72 729.96 1102.41 1496.04 1762.84 1779.99 1704.28 1506.24 1241.83 837.29 488.36 335.52 (83)
Temperature factor from Table 2b 1.00 (53)	Total gains - internal and solar (73)m + (83)m
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) 0.10 (54)	950.39 1278.35 1631.56 1993.59 2227.27 2213.27 2117.79 1926.41 1678.63 1305.93 993.66 869.32 (84)
Enter (50) or (54) in (55) 0.10 (55)	
Water storage loss calculated for each month (55) x (41)m	7. Mean internal temperature (heating season)
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (56)	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)	Utilisation factor for gains for living area n1,m (see Table 9a)
URN: KCS1-A1 version 14	URN: KCS1-A1 version 14
NHER Plan Assessor version 6.3.4	NHER Plan Assessor version 6.3.4
Page 2 SAP version 9.92	Page 3 SAP version 9.92

Acon intern-	0.97	0.94	0.88	0.77	0.63	0.48	0.36	0.41	0.62	0.86	0.95	0.98	(86)
Aean internal						20.00	20.00	20.05	20.77	20.46	40.00	10.00	
emperature d	18.67	19.09	19.66	20.27	20.68	20.89	20.96	20.95	20.77	20.16	19.29	18.60	(87)
emperature u	20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.06	20.05	20.04	20.04	20.03	(88)
Jtilisation facto					20.04	20.05	20.05	20.06	20.05	20.04	20.04	20.05	] (00)
	0.97	0.93	0.87		0.59	0.42	0.29	0.22	0.56	0.83	0.95	0.08	(00)
Aean internal				0.75				0.33	0.56	0.83	0.95	0.98	(89)
iean interna	16.89	17.49	18.31	19.16	19.69	19.96	20.03	20.02	19.83	19.03	17.79	16.80	(00)
iving area frac		17.49	10.51	19.10	19.09	19.90	20.05	20.02		ving area ÷	·	0.52	(90) (91)
Aean internal		for the wh	ole dwellin	σ fl Λ v T1 J	L(1 - fl A) y	т2			L	vilig alea ÷	(4) -	0.32	] (91)
iean interna	17.82	18.33	19.01	19.74	20.21	20.45	20.52	20.51	20.32	19.62	18.57	17.74	(92)
Apply adjustme								20.51	20.52	15.02	10.57	17.74	] (32)
	17.82	18.33	19.01	19.74	20.21	20.45	20.52	20.51	20.32	19.62	18.57	17.74	(93)
	17.02	10.55	15.01	15.74	20.21	20.45	20.52	20.51	20.52	15.02	10.57	17.74	] (33)
8. Space heat	ing requirem	nent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor	or for gains, ı	ηm											
	0.96	0.92	0.85	0.74	0.60	0.45	0.33	0.37	0.58	0.82	0.93	0.96	(94)
Jseful gains, ηι	mGm, W (94	l)m x (84)n	n										
	908.88	1171.61	1384.03	1467.34	1328.59	986.71	689.26	711.31	976.18	1065.30	924.67	838.21	(95)
Aonthly average	ge external to	emperatur	e from Tabl	e U1									
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
leat loss rate f	for mean inte	ernal temp	erature, Lm	, W [(39)m	n x [(93)m -	(96)m]							
	2552.91	2528.02	2348.91	2004.92	1568.97	1062.76	712.23	744.18	1137.63	1663.13	2128.35	2526.93	(97)
pace heating i	requirement	LAN/b/mor		(07)	-> 2 ()								
	- equilement,	, күүп/шөг	1th 0.024 x	[(97)m - (9	5)mJ x (41)	m							
	1223.16	911.51	717.87	(97)m - (9 387.06	5)m] x (41) 178.84	m 0.00	0.00	0.00	0.00	444.78	866.65	1256.40	]
		1					0.00	0.00	1	444.78 8)15, 10	·	1256.40 5986.28	(98)
pace heating r	1223.16	911.51	717.87				0.00	0.00	1	8)15, 10	·		] (98) (99)
	1223.16	911.51 kWh/m²/y	717.87 rear	387.06			0.00	0.00	1	8)15, 10	.12 = 5	5986.28	1
9b. Energy ree	1223.16 requirement quirements -	911.51 kWh/m²/y communi	717.87 rear ty heating s	387.06	178.84	0.00	0.00	0.00	1	8)15, 10 (98)	.12 = ÷ (4)	5986.28 34.07	] (99)
9b. Energy ree	1223.16 requirement quirements - ce heat from	911.51 kWh/m²/y communi secondary	717.87 rear ty heating s r/suppleme	387.06	178.84	0.00	0.00	0.00	1	8)15, 10 (98) '0' if	.12 = 5 ÷ (4)	5986.28 34.07 0.00	) (99) (301)
9b. Energy rec raction of spa raction of spa	1223.16 requirement quirements - ce heat from ce heat from	911.51 kWh/m²/y communi secondary communit	717.87 rear ty heating s ı/suppleme ty system	387.06	178.84	0.00	0.00	0.00	1	8)15, 10 (98) '0' if	.12 = ÷ (4)	0.00 1.00	(99) (301) (302)
9b. Energy ree fraction of spa fraction of spa fraction of com	1223.16 requirement quirements - ce heat from ce heat from nmunity heat	911.51 kWh/m²/y communit secondary communit t from boile	717.87 rear ty heating s r/suppleme ty system ers	387.06	178.84	0.00	0.00	0.00	1	8)15, 10 (98) '0' if	.12 = 5 ÷ (4)	0.00 0.30	(99) (301) (302) (303a)
9b. Energy ree fraction of spa fraction of spa fraction of con	1223.16 requirement quirements - ce heat from ce heat from nmunity heat nmunity heat	911.51 kWh/m²/y communit secondary communit t from boile t from CHP	717.87 rear ty heating s r/suppleme ty system ers	387.06 scheme ntary syste	178.84	0.00	0.00	0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3	.12 = 5 ÷ (4) 5 none 5 01) = 5 5 5 5 5 5 5 5 5 5 5 5 5 5	0.00 1.00 0.30 0.70	(99) (301) (302) (303a) (303b)
9b. Energy ree fraction of spa fraction of spa fraction of com	1223.16 requirements - ce heat from ce heat from nmunity heat al space heat	911.51 kWh/m²/y communit secondary communit t from boile t from CHP from com	717.87 rear ty heating s //suppleme ty system ers munity CHP	387.06	178.84	0.00	0.00	0.00	Σ(9)	8)15, 10 (98) '0' if	.12 = 5 ÷ (4) none 01) = 5 3a) = 5	0.00 0.30	(99) (301) (302) (303a)
9b. Energy red raction of spa raction of spa raction of con raction of con raction of tota	1223.16 requirement quirements - ce heat from ce heat from nmunity heat anmunity heat al space heat al space heat	911.51 kWh/m²/y communi secondary communit t from boile t from CHP from comm	717.87 rear ty heating s ty system ers munity CHP munity boild	387.06	178.84	0.00		0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 5 3a) = 5	0.00 1.00 0.30 0.70 0.30 0.70 0.30	(99) (301) (302) (303a) (303b) (304b)
9b. Energy red iraction of spa iraction of spa iraction of con iraction of con iraction of tota iraction of tota	1223.16 requirement quirements - ce heat from ce heat from nmunity heat al space heat al space heat rol and charg	911.51 kWh/m²/y communit secondary communit t from boild t from CHP from comm from comm ging metho	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil d (Table 4cd	387.06 cheme ntary syste ers (3)) for com	178.84 m (table 11 nmunity sp:	0.00		0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 3a) = 	5986.28 34.07 1.00 0.30 0.70 0.70 0.30 1.00	(99) (301) (302) (303a) (303b) (304a) (304b) (305)
9b. Energy red iraction of spa iraction of spa iraction of com iraction of com iraction of tota iraction of tota iraction of tota iractor for cont	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat rol and charg ging method	911.51 kWh/m²/y communit secondary communit t from boile t from CHP from comm from comm ging metho (Table 4c(:	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 3a) = 	0.00           1.00           0.30           0.70           0.70           0.30           1.00           1.00           1.00           1.00           1.00	(99) (301) (302) (303a) (303b) (304a) (304b) (305) (305a)
9b. Energy red iraction of spa iraction of spa iraction of con iraction of con iraction of tota iraction of tota	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat rol and charg ging method	911.51 kWh/m²/y communit secondary communit t from boile t from CHP from comm from comm ging metho (Table 4c(:	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 3a) = 	5986.28 34.07 1.00 0.30 0.70 0.70 0.30 1.00	(99) (301) (302) (303a) (303b) (304a) (304b) (305)
9b. Energy red iraction of spa iraction of spa iraction of com iraction of com iraction of tota iraction of tota iraction of tota iractor for cont	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat rol and charg ging method	911.51 kWh/m²/y communit secondary communit t from boile t from CHP from comm from comm ging metho (Table 4c(:	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		0.00	Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 3a) = 	0.00         1.00           0.30         0.70           0.70         0.30           1.00         1.00           1.00         1.00	(99) (301) (302) (303a) (303b) (304a) (304b) (305) (305a)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iractor of tota iractor for cont isactor for cont isactor for char Distribution los	1223.16 requirement quirements - ce heat from nomunity heat nomunity heat al space heat al space heat rol and charg ging method ss factor (Tab	911.51 kWh/m²/y communi secondary communit from boild from CHP from coming from coming ging metho (Table 4c(: ole 12c) for	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00			Σ(9)	8)15, 10 (98) '0' if 1 - (3 (302) × (30	.12 = 5 ÷ (4) none 01) = 5 3a) = 5	0.00         1.00           0.30         0.70           0.70         0.30           1.00         1.00           1.00         1.00	(99) (301) (302) (303a) (303b) (304a) (304b) (304b) (305a) (305a) (306)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iractor of tota iractor for cont isactor for cont obstribution los	1223.16 requirement quirements - ce heat from neunity heat neunity heat al space heat al space heat rol and charg ging method ss factor (Tab	911.51 kWh/m²/y communi secondary communit from boild from CHP from coming from coming ging metho (Table 4c(: ole 12c) for	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00			<u>Σ</u> (9)	(98) (98) (98) (98) (98) (98) (98) (98)	.12 =	9986.28 34.07 1.00 0.30 0.70 0.30 0.70 0.30 1.00 1.00 1.05	(99) (301) (302) (303a) (303b) (304a) (304b) (304b) (305) (305a) (306)
9b. Energy red iraction of spa iraction of spa iraction of com iraction of tota iraction of tota iraction of tota iractor for cont iractor for	1223.16 requirement quirements - ce heat from nmunity heat nmunity heat al space heat al space heat rol and charg ging method ss factor (Tab	911.51 kWh/m²/y communi secondary communit from boild from CHP from coming from coming ging metho (Table 4c(: ole 12c) for	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00			Σ(9 5986.28 8) x (304a)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	34.07 0.00 1.00 0.30 0.70 0.70 0.70 0.30 1.00 1.00 1.00 1.05 4399.91	(99) (301) (302) (303a) (303b) (304a) (304b) (305a) (305a) (305a) (306) (98) (307a)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iractor of tota iractor for cont isactor for cont obstribution los	1223.16 requirement quirements - ce heat from nmunity heat nmunity heat al space heat al space heat rol and charg ging method ss factor (Tab	911.51 kWh/m²/y communi secondary communit from boild from CHP from coming from coming ging metho (Table 4c(: ole 12c) for	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00			<u>Σ</u> (9)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	9986.28 34.07 1.00 0.30 0.70 0.30 0.70 0.30 1.00 1.00 1.05	(99) (301) (302) (303a) (303b) (304a) (304b) (304b) (305) (305a) (306)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iractor for cont iractor for	1223.16 requirement quirements - ce heat from ce heat from nmunity heat al space heat al space heat al space heat rol and charg ging method ss factor (Tab heating require m CHP m boilers	911.51 kWh/m²/y communi secondary communit from boild from CHP from coming from coming ging metho (Table 4c(: ole 12c) for	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00			Σ(9 5986.28 8) x (304a)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	34.07 0.00 1.00 0.30 0.70 0.70 0.70 0.30 1.00 1.00 1.00 1.05 4399.91	(99) (301) (302) (303a) (303b) (304a) (304b) (305a) (305a) (305a) (306) (98) (307a)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iraction of tota iractor for cont iractor for cont iractor for cont iractor for cont iractor for cont iractor for charp Distribution los ipace heating ipace heat from ipace heat from ipace heat from	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat rol and charg ging method ss factor (Tab heating require m CHP m boilers	911.51 kWh/m²/y communit secondary communit t from boild t from CHP from comu from comu ging metho (Table 4c(: ble 12c) for rement	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		(9) (9)	<u>Σ</u> (9) 5986.28 8) x (304a) 8) x (304b)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	34.07 0.00 1.00 0.30 0.70 0.70 0.70 0.30 1.00 1.00 1.00 1.05 4399.91	(99) (301) (302) (303a) (303b) (304a) (304b) (305) (305) (305a) (306) (98) (307a) (307b)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iractor for cont iractor for	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat rol and charg ging method ss factor (Tab heating require m CHP m boilers	911.51 kWh/m²/y communit secondary communit t from boild t from CHP from comu from comu ging metho (Table 4c(: ble 12c) for rement	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		(9) (9)	Σ(9 5986.28 8) x (304a)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	34.07 0.00 1.00 0.30 0.70 0.70 0.70 0.30 1.00 1.00 1.00 1.05 4399.91	(99) (301) (302) (303a) (303b) (304a) (304b) (305a) (305a) (305a) (306) (98) (307a)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iraction of tota iractor for cont iractor for cont iractor for cont iractor for cont iractor for cont iractor for charp Distribution los ipace heating ipace heat from ipace heat from ipace heat from	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat al space heat rol and charg ging method ss factor (Tab heating require m CHP m boilers	911.51 kWh/m²/y communit secondary communit t from boild t from CHP from comu from comu ging metho (Table 4c(: ble 12c) for rement	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		(9) (9)	<u>Σ</u> (9) 5986.28 8) x (304a) 8) x (304b)	(98) (98) (98) (98) (98) (98) (98) (98)	12 = 5 $\div (4)$ (4) (1) = 5 (3a) = 5 (1) = 5 (1) = 5 (2) = 5 (2) = 5 (2) = 5 (2) = 5 (3a) = 5	34.07 0.00 1.00 0.30 0.70 0.70 0.70 0.30 1.00 1.00 1.00 1.05 4399.91	(99) (301) (302) (303a) (303b) (304a) (304b) (305) (305) (305a) (306) (98) (307a) (307b)
9b. Energy red iraction of spa iraction of com iraction of com iraction of tota iraction of tota iraction of tota iractor for cont iractor for	1223.16 requirement ce heat from ce heat from nmunity heat al space heat al space heat al space heat rol and charg ging method ss factor (Tab heating require m CHP m boilers	911.51 kWh/m²/y communit secondary communit t from boild t from CHP from comu from comu ging metho (Table 4c(: ble 12c) for rement	717.87 rear ty heating s r/suppleme ty system ers munity CHP munity boil id (Table 4ci 3)) for com	387.06 cheme ntary syste ers (3)) for com nunity wat	178.84 m (table 11 nmunity spi er heating	0.00		(9) (9)	<u>Σ</u> (9) 5986.28 8) x (304a) 8) x (304b)	(98) (98) (98) (98) (98) (98) (98) (98)	$\begin{array}{c} 1.12 = 5 \\ \div (4) \\ \hline \\ 001) = \\ \hline \\ 3a) = \\ \hline \\ 3b) = \\ \hline \\ 06) = \\ \hline \\ 06) = \\ \hline \\ 2a \\ c \\ $	9986.28 34.07 0.00 1.00 0.30 0.70 0.70 0.30 1.00 1.00 1.00 1.05	(99) (301) (302) (303a) (303b) (304a) (304b) (305a) (305a) (305a) (306) (98) (307a) (307b) (64)

Water heat from CHP			(64) x (303a) x (305a) x (3	306) = 1440.60	(310
Water heat from boilers			(64) x (303b) x (305a) x (3	306) = 617.40	(310
Electricity used for heat distribution		0.01 ×	[(307a)(307e) + (310a)(31	0e)] = 83.44	(313
Electricity for pumps, fans and electric keep-hot (Table 4f)					
mechanical ventilation fans - balanced, extract or positive in	put from outside		383.38		(330
Total electricity for the above, kWh/year				383.38	(331
Electricity for lighting (Appendix L)				546.80	(332
Energy saving/generation technologies					
electricity generated by PV (Appendix M)				-661.63	(333
Total delivered energy for all uses	(307) + (309) +	(310) + (31	.2) + (315) + (331) + (332)(33	37b) = 8612.14	(338
10b. Fuel costs - community heating scheme					
	Fuel kWh/year		Fuel price	Fuel cost £/year	
Space heating from CHP	4399.91	x	2.97 x 0.03	1 = 130.68	(340
Space heating from boilers	1885.68	x	4.24 x 0.02	1 = 79.95	(340
Water heating from CHP	1440.60	x	2.97 x 0.02	1 = 42.79	(342
Water heating from boilers	617.40	x	4.24 x 0.02	1 = 26.18	(342
Pumps and fans	383.38	x	13.19 x 0.02	1 = 50.57	(349
Electricity for lighting	546.80	×	13.19 x 0.03	1 = 72.12	(350
Additional standing charges				120.00	(351
Energy saving/generation technologies					
pv savings	-661.63	x	13.19 x 0.02	1 = 0.00	(352
Total energy cost			(340a)(342e) + (345)(3	354) = 522.28	(355
11b. SAP rating - community heating scheme					
Energy cost deflator (Table 12)				0.42	(356
Energy cost factor (ECF)				0.99	(357)
SAP value				86.13	]
SAP rating (section 13)				86	(358
SAP band				В	]
12b. CO <sub>2</sub> emissions - community heating scheme					
	Energy kWh/year		Emission factor	Emissions (kg/year)	
Emissions from community CHP (space and water heating)					
Power efficiency of CHP unit	31.50				(361

Space heating from CHP         (307a) × 100 ÷ (362) =         9071.2496         x         0.2160         =         1959.3899         (363)           less credit emissions for electricity         -2857.0865         x         0.5190         =         -1482.8279         (364)	Power efficiency of CHP unit		31.50					(361)
less credit emissions for electricity -2857.0865 x 0.5190 = -1482.8279 (364)	Heat efficiency of CHP unit		48.50					(362)
	Space heating from CHP	(307a) × 100 ÷ (362) =	9071.2496	х	0.2160	=	1959.3899	(363)
Water heated by CHP         2970.0618         x         0.2160         =         641.5334         (365)	less credit emissions for electrici	ty	-2857.0865	х	0.5190	=	-1482.8279	(364)
	Water heated by CHP		2970.0618	х	0.2160	=	641.5334	(365)
less credit emissions for electricity -935.4525 x 0.5190 = -485.4999 (366)	less credit emissions for electrici	ty	-935.4525	х	0.5190	=	-485.4999	(366)
Emissions from other sources (space heating)	Emissions from other sources (space	e heating)						
Efficiency of boilers 91.80 (367)	Efficiency of boilers		91.80					(367b)
CO2 emissions from boilers $[(307b)+(310b)] \times 100 \div (367b) = 2726.66$ x 0.216 = 588.96 (368)	CO2 emissions from boilers [(30	07b)+(310b)] x 100 ÷ (367b) =	2726.66	х	0.216	=	588.96	(368)
Electrical energy for community heat distribution 83.44 x 0.519 = 43.30 (372)	Electrical energy for community hea	at distribution	83.44	х	0.519	=	43.30	(372)
Total CO2 associated with community systems 1264.86 (373)	Total CO2 associated with communi	ty systems					1264.86	(373)
Total CO2 associated with space and water heating 1264.86 (376)	Total CO2 associated with space and	d water heating					1264.86	(376)

Page 5

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Pumps and fans	383.38	х	0.519	=	198.98	(378)
Electricity for lighting	546.80	х	0.519	=	283.79	(379)
Energy saving/generation technologies						
pv savings	-661.63	х	0.519	=	-343.39	(380)
Total CO <sub>2</sub> , kg/year				(376)(382) =	1404.24	(383)
Dwelling CO <sub>2</sub> emission rate				(383) ÷ (4) =	7.99	(384)
El value					91.47	]
El rating (section 14)					91	(385)
El band					В	]

### 13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)	1
Primary Energy from community CHP (space and water heating)						
Power efficiency of CHP unit	31.50					(361)
Heat efficiency of CHP unit	48.50					(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	9071.25	x	1.22	=	11066.92	(363)
less credit energy for electricity	-2857.09	x	3.07	=	-8771.26	(364)
Water heated by CHP	2970.06	x	1.22	=	3623.48	(365)
less credit energy for electricity	-935.45	x	3.07	=	-2871.84	(366)
Primary energy from other sources (space heating)						
Efficiency of boilers	91.80					(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) =	2726.66	х	1.22	=	3326.53	(368)
Electrical energy for community heat distribution	83.44	x	3.07	=	256.15	(372)
Total primary energy associated with community systems					6629.98	(373)
Total primary energy associated with space and water heating					6629.98	(376)
Pumps and fans	383.38	x	3.07	=	1176.98	(378)
Electricity for lighting	546.80	x	3.07	=	1678.67	(379)
Energy saving/generation technologies						
Electricity generated - PVs	-661.63	x	3.07	=	-2031.20	(380)
Primary energy kWh/year					7454.43	(383)
Dwelling primary energy rate kWh/m2/year					42.43	(384)

# DER Worksheet



Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address	A1, London		

### 1. Overall dwelling dimensions

		Area (m²)		Average storey height (m)	Volume (m³)
Lowest occupied		110.05 (1a)	x	2.70 (2a) =	297.14 (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	110.05 (4)			
Dwelling volume				(3a) + (3b) + (3c) + (3d)(3n) =	= 297.14 (5)

### 2. Ventilation rate

											1	n° per hour	
Number of chim	neys								0	x 40 =	-	0	(6a)
Number of open	flues								0	] x 20 =	-	0	(6b)
Number of inter	mittent fan	IS							0	x 10 =	-	0	(7a)
Number of passi	ve vents								0	] x 10 =	-	0	(7b)
Number of fluele	ess gas fires	5							0	] x 40 =	-	0	(7c)
											Ai	r changes pe hour	er
Infiltration due t	o chimneys	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7	a) + (7b) + (	7c) =	0	] ÷ (5) =	-	0.00	(8)
lf a pressurisatio	n test has l	been carried	d out or is i	ntended, p	roceed to (2	17), otherw	ise continue	e from (9) t	o (16)				
Air permeability	value, q50	, expressed	in cubic m	etres per h	our per squ	iare metre	of envelope	e area				3.00	(17)
If based on air pe	ermeability	value, the	n (18) = [(1	7) ÷ 20] + (	8), otherwis	se (18) = (1	6)					0.15	(18)
Number of sides	on which t	he dwelling	g is sheltere	ed								1	(19)
Shelter factor									1 -	[0.075 x (1	9)] =	0.93	(20)
Infiltration rate i	ncorporati	ng shelter f	actor							(18) x (2	20) =	0.14	(21)
Infiltration rate r	modified fo	or monthly v	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average	e wind spee	ed from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)	m÷4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a
Adjusted infiltrat	tion rate (a	llowing for	shelter and	d wind fact	or) (21) x (2	2a)m							
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	(22b
Calculate effective	ve air chan	ge rate for	the applica	ble case:									
If mechanical	ventilation	n: air chang	e rate thro	ugh system	ı							0.50	(23a
If balanced w	ith heat re	covery: effi	ciency in %	allowing f	or in-use fa	ctor from T	able 4h					79.90	(23c
a) If balanced	l mechanic	al ventilatio	on with hea	t recovery	(MVHR) (22	2b)m + (23b	o) x [1 - (230	c) ÷ 100]					
	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(24a
Effective air char	nge rate - e	nter (24a) o	or (24b) or	(24c) or (2	4d) in (25)								
Effective air char	nge rate - e 0.28	nter (24a) o 0.27	or (24b) or 0.27	(24c) or (2 0.25	4d) in (25) 0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(25)

Page 1



3. Heat losses and heat loss parameter	3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         (57)
Element Gross Openings Net area U-value A x U W/K ĸ-value, A x ĸ,	Primary circuit loss for each month from Table 3
area, m² M, m² W/m²K kJ/m².K kJ/K	23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 23.26 22.51 23.26 (59)
Window 40.70 x 1.05 = 42.88 (27)	Combi loss for each month from Table 3a, 3b or 3c
Ground floor 110.05 x 0.09 = 9.90 (28a)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)
External wall 74.41 x 0.18 = 13.39 (29a)	Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m
Party wall $21.57 \times 0.00 = 0.00$ (32)	191.36 168.12 175.28 155.36 150.96 133.05 126.02 140.71 141.21 161.19 172.66 186.15 (62)
Total area of external elements $\Sigma A$ , m <sup>2</sup> 225.16 (31)	Solar DHW input calculated using Appendix G or Appendix H
Fabric heat loss, $W/K = \sum (A \times U)$ (26)(30) + (32) = 66.18 (33)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)
Heat capacity $Cm = \sum (A \times K)$ (28)(30) + (32) + (32a)(32e) = N/A (34)	Output from water heater for each month (kWh/month) (62)m + (63)m
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K [100.00] (35)	191.36 168.12 175.28 155.36 150.96 133.05 126.02 140.71 141.21 161.19 172.66 186.15
Thermal bridges: $\Sigma(L \times \Psi)$ calculated using Appendix K (36)	
Total fabric heat loss $(33) + (36) = 99.96$ (37)	
	Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
	76.01         67.09         70.67         63.65         62.58         56.23         54.29         59.17         58.94         65.98         69.40         74.28         (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	5. Internal gains
27.20 26.86 26.52 24.82 24.48 22.78 22.78 22.44 23.46 24.48 25.16 25.84 (38)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coefficient, W/K (37)m + (38)m	Metabolic gains (Table 5)
127.16 126.82 126.48 124.78 124.44 122.73 122.73 122.39 123.41 124.44 125.12 125.80	140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 140.76 (66)
Average = $\Sigma(39)112/12 = 124.69$ (39)	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	Z4.22         Z1.51         17.49         13.24         9.90         8.36         9.03         11.74         15.75         20.00         23.35         24.89         (67)
1.16 1.15 1.15 1.13 1.13 1.12 1.12 1.11 1.12 1.13 1.14 1.14	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
Average = $\Sigma(40)112/12 = 1.13$ (40)	
Number of days in month (Table 1a)	271.63 274.45 267.34 252.22 233.13 215.19 203.21 200.39 207.49 222.62 241.70 259.64 (68)
31.00         28.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         400	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
	37.08         37.08 <th< td=""></th<>
4. Water heating energy requirement	Pump and fan gains (Table 5a)
Assumed occupancy, N 2.82 (42)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)
Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 [101.06] (43)	Losses e.g. evaporation (Table 5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	<u>-112.61</u> -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 -112.61 (71)
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	Water heating gains (Table 5)
111.17         107.12         103.08         99.04         95.00         90.95         90.95         95.00         99.04         103.08         107.12         111.17	102.17         99.84         94.99         88.40         84.12         78.09         72.97         79.53         81.87         88.69         96.39         99.85         (72)
$\Sigma(44)112 = 1212.71  (44)$	Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	463.24         461.02         445.05         419.09         392.38         366.87         350.44         356.89         370.34         396.53         426.67         449.60         (73)
164.85         144.18         148.78         129.71         124.46         107.40         99.52         114.21         115.57         134.68         147.02         159.65	
Σ(45)112 = <u>1590.06</u> (45)	6. Solar gains
Distribution loss 0.15 x (45)m	Access factor Area Solar flux g FF Gains Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W
24.73         21.63         22.32         19.46         18.67         16.11         14.93         17.13         17.34         20.20         22.05         23.95         (46)	or Table 6b or Table 6c
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00 (47)	East 0.77 x 14.57 x 19.64 x 0.9 x 0.55 x 0.80 = 87.26 (76)
Water storage loss:	South 0.77 x 9.83 x 46.75 x 0.9 x 0.55 x 0.80 = 140.13 (78)
b) Manufacturer's declared loss factor is not known	West $0.77 \times 16.30 \times 19.64 \times 0.9 \times 0.55 \times 0.80 = 97.62$ (80)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)	Solar gains in watts $\Sigma(74)$ m(82)m
Volume factor from Table 2a 4.93 (52)	325.00 591.15 887.93 1199.03 1408.84 1421.09 1361.22 1205.58 998.08 676.66 396.62 273.12 (83)
Temperature factor from Table 2b	
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53)	Total gains - internal and solar (73)m + (83)m 788.24 1052.17 1332.98 1618.12 1801.22 1787.96 1711.66 1562.47 1368.42 1073.20 823.28 722.72 (84)
Enter (50) or (54) in (55) 0.10 (55)	788.24 1052.17 1332.98 1618.12 1801.22 1787.96 1711.66 1562.47 1368.42 1073.20 823.28 722.72 (84)
Water storage loss calculated for each month (55) x (41)m	7. Mean internal temperature (heating season)
3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         5.6	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
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NHER Plan Assessor version 6.3.4 Page 2 SAP version 9.92	NHER Plan Assessor version 6.3.4 Page 3 SAP version 9.92
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	0.95	0.91	0.83	0.70	0.55	0.41	0.31	0.34	0.54	0.79	0.92	0.96	(86)
Mean internal te	emp of livin	g area T1 (s	teps 3 to 7	in Table 9c	)								
	18.77	19.23	19.81	20.38	20.74	20.91	20.97	20.96	20.82	20.27	19.40	18.69	(87)
Temperature du	ring heatin	g periods in	the rest of	dwelling fr	om Table 9	9, Th2(°C)							
	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)
Utilisation facto	r for gains f	or rest of d	welling n2,	m									
	0.94	0.89	0.80	0.67	0.51	0.35	0.24	0.27	0.48	0.75	0.91	0.95	(89)
Mean internal te	emperature	in the rest	of dwelling	T2 (follow	steps 3 to	7 in Table 9	∋c)						
	17.00	17.65	18.46	19.24	19.70	19.92	19.97	19.96	19.81	19.12	17.91	16.88	(90)
Living area fract	ion								Liv	ving area ÷	(4) =	0.38	(91)
Mean internal te	emperature	for the wh	ole dwellin	g fLA x T1 +	(1 - fLA) x	Т2					_		_
	17.67	18.25	18.98	19.68	20.09	20.30	20.35	20.34	20.20	19.56	18.48	17.57	(92)
Apply adjustmer	nt to the me	ean internal	temperatu	ure from Ta	ble 4e whe	ere appropr	iate						_
	17.67	18.25	18.98	19.68	20.09	20.30	20.35	20.34	20.20	19.56	18.48	17.57	(93)
8. Space heatir	ng requirem	ent											
o. opuce neutri	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto									ocp.			200	
	0.92	0.87	0.78	0.65	0.51	0.37	0.26	0.30	0.49	0.74	0.88	0.93	(94)
Useful gains, ηm	·			0.05	0.01	0.07	0.20	0.50	0.15	0.71	0.00	0.55	] (3 .)
,, -	727.25	911.71	1041.00	1059.62	923.52	662.85	450.08	467.85	674.17	792.78	727.91	675.41	(95)
Monthly average													] ()
, ,	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo													] ( )
	1700.39	1693.44	1577.84		1044.37	699.01	460.40	482.62	752.30	1114.68	1423.42	1681.75	(97)
Space heating re	quirement	, kWh/mon	th 0.024 x	[(97)m - (9!	5)m] x (41)	m	V						_
	724.01	525.32	399.41	205.24	89.91	0.00	0.00	0.00	0.00	239.49	500.76	748.72	1
									Σ(98	3)15, 10	.12 =	3432.87	(98)
Space heating re	equirement	kWh/m²/ye	ear							(98)	÷ (4)	31.19	(99)
			_										-
9b. Energy req	uirements -	communit	y heating s	cheme			_						
Fraction of space				ntary system	m (table 11	L)				'0' if ı		0.00	(301)
Fraction of space										1 - (30	01) =	1.00	(302)
Fraction of com			rs									0.30	(303a
Fraction of com										(222) (22		0.70	] (303b
Fraction of total										(302) x (303		0.70	] (304a
Fraction of total										(302) x (303	3b) = [	0.30	(304b
Factor for contro						ace neating						1.00	(305) (305)
Factor for charg	-			-	-							1.00	] (305a
Distribution loss	Tactor (Tab	ne 12c) for	community	neating sy	stem							1.05	(306)
Space heating	ating '	romort							422.07	1			(00)
Annual space he		rement							432.87	(205) (2)	nc) - 🔽	1522.40	(98) (2075
Space heat from										x (305) x (30 x (205) x (20		2523.16	(307a) (307b)
Space heat from	Doners							(98	y x (3040) x	k (305) x (30	uo) = [ 0	1081.35	] (307p
Water heating													

Annual water heating requirement		1902.08	]	
Water heat from CHP		(64) x (303a) x	(305a) x (306) =	1398.03
Water heat from boilers		(64) x (303b) x	(305a) x (306) =	599.15
Electricity used for heat distribution		0.01 × [(307a)(307e) + (3	310a)(310e)] =	56.02
Electricity for pumps, fans and electric keep-hot (Table 4f)			_	
mechanical ventilation fans - balanced, extract or positive	input from outside	240.16		
Total electricity for the above, kWh/year				240.16
Electricity for lighting (Appendix L)				427.66
Energy saving/generation technologies				
electricity generated by PV (Appendix M)				-410.67
Total delivered energy for all uses	(307) + (309) +	(310) + (312) + (315) + (331) +	(332)(337b) =	5858.85
10b. Fuel costs - community heating scheme	Fuel	Fuel price		Fuel
	kWh/year	i dei price		cost £/year
Space heating from CHP	2523.16	x 2.97	x 0.01 =	74.94
Space heating from boilers	1081.35	x 4.24	x 0.01 =	45.85
Water heating from CHP	1398.03	x 2.97	x 0.01 =	41.52
Water heating from boilers	599.15	x 4.24	x 0.01 =	25.40
Pumps and fans	240.16	x 13.19	x 0.01 =	31.68
Electricity for lighting	427.66	x 13.19	x 0.01 =	56.41
Additional standing charges				120.00
Energy saving/generation technologies			1	[
pv savings	-410.67	x 13.19	x 0.01 =	0.00
Total energy cost		(340a)(342e)	+ (345)(354) =	395.80
11b. SAP rating - community heating scheme				
Energy cost deflator (Table 12)				0.42
Energy cost factor (ECF)				1.07
SAP value				85.04
SAP rating (section 13)				85
SAP band				В
12b. CO <sub>2</sub> emissions - community heating scheme	Energy	Emission factor		Emissions
Emissions from community CHP (space and water heating)	kWh/year			(kg/year)
Power efficiency of CHP unit	31.50			
Heat efficiency of CHP unit	48.50			
Space heating from CHP (307a) × 100 ÷ (362		x 0.2160	] =	1123.6250
less credit emissions for electricity	-1638.4150	x 0.5190	] =	-850.3374
Water heated by CHP	2882.2936	x 0.2160	] =	622.5754
less credit emissions for electricity	-907.8090	x 0.5190	] =	-471.1529
Emissions from other sources (space heating)			-	
Efficiency of boilers	91.80			
		x 0.216	] =	395.41
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b	56.02	x 0.519	] =	29.07
CO2 emissions from boilers [(307b)+(310b)] x 100 ÷ (367b) Electrical energy for community heat distribution	36.02			
	50.02			849.20

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Total CO2 associated with space and water heating					849.20	(376)
Pumps and fans	240.16	x	0.519	=	124.64	(378)
Electricity for lighting	427.66	х	0.519	=	221.95	(379)
Energy saving/generation technologies						
pv savings	-410.67	x	0.519	=	-213.14	(380)
Total CO <sub>2</sub> , kg/year				(376)(382) =	982.66	(383)
Dwelling CO₂ emission rate				(383) ÷ (4) =	8.93	(384)
El value					91.51	]
El rating (section 14)					92	(385)
El band					А	]

### 13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating	<i>(</i> 1				
Power efficiency of CHP unit	31.50				(361)
Heat efficiency of CHP unit	48.50				(362)
Space heating from CHP $(307a) \times 100 \div (362)$	) = 5201.97	x	1.22	=	6346.40 <mark>(363)</mark>
less credit energy for electricity	-1638.42	x	3.07	=	-5029.93 ( <mark>364</mark> )
Water heated by CHP	2882.29	x	1.22	=	3516.40 (365)
less credit energy for electricity	-907.81	x	3.07	=	-2786.97 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	91.80				(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b	) = 1830.62	x	1.22	=	2233.35 (368)
Electrical energy for community heat distribution	56.02	x	3.07	=	171.97 ( <mark>372</mark> )
Total primary energy associated with community systems					4451.22 (373)
Total primary energy associated with space and water heating					4451.22 ( <mark>376</mark> )
Pumps and fans	240.16	x	3.07	=	737.29 (378)
Electricity for lighting	427.66	x	3.07	=	1312.91 ( <mark>379</mark> )
Energy saving/generation technologies					
Electricity generated - PVs	-410.67	x	3.07	=	-1260.74 (380)
Primary energy kWh/year					5240.67 (383)
Dwelling primary energy rate kWh/m2/year					47.62 (384)

# DER Worksheet



Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Liam Holden	Assessor number	10245
Client		Last modified	20/06/2018
Address	TH A1, London		

### 1. Overall dwelling dimensions

		Area (m²)		Average storey height (m)		Volume (m³)
Lowest occupied		69.47	(1a) x	2.70	(2a) =	187.57 ( <mark>3</mark> a)
+1		41.56	(1b) x	3.15	(2b) =	130.91 (3b)
Total floor area	(1a) + (1b) + (1c) + (1d)(1n) =	111.03	(4)			
Dwelling volume				(3a) + (3b) + (3c)	+ (3d)(3n) =	318.48 (5)

2. Ventilation rate

											m	<sup>3</sup> per hour	
Number of chim	nneys								0	] x 40 =	-	0	(6a)
Number of oper	n flues								0	] x 20 =	=	0	(6b)
Number of inter	rmittent fan	S							0	] x 10 =	-	0	(7a)
Number of pass	ive vents								0	] x 10 =	=	0	(7b)
Number of flue	ess gas fires	5							0	] x 40 =	-	0	(7c)
											Air	changes pe hour	r
Infiltration due	to chimneys	s, flues, fan	s, PSVs		(6a)	+ (6b) + (7a	a) + (7b) + (	7c) =	0	) ÷ (5) :	=	0.00	(8)
lf a pressurisatio	on test has l	been carrie	d out or is i	ntended, pi	roceed to (1	17), otherw	ise continu	e from (9)	to (16)				
Air permeability	value, q50,	, expressed	in cubic m	etres per h	our per squ	are metre	of envelope	e area				3.00	(17)
If based on air p	ermeability	value, the	n (18) = [(1	7) ÷ 20] + (8	3), otherwis	se (18) = (16	5)					0.15	(18)
Number of side	s on which t	he dwelling	g is sheltere	ed								1	(19)
Shelter factor									1 -	[0.075 x (1	.9)] =	0.93	(20)
Infiltration rate	incorporati	ng shelter f	actor							(18) x (	20) =	0.14	(21)
Infiltration rate	modified fo	r monthly	wind speed	:									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly averag	e wind spee	ed from Tab	ole U2										
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22	)m ÷ 4												
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltra	ation rate (a	llowing for	shelter and	d wind facto	or) (21) x (2	2a)m							
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16	(22b)
Calculate effect	ive air chan	ge rate for	the applica	ble case:									
If mechanica	I ventilation	n: air chang	e rate thro	ugh system								0.50	(23a)
If balanced v	vith heat ree	covery: effi	ciency in %	allowing fo	or in-use fa	ctor from T	able 4h					79.90	(23c)
a) If balance	d mechanica	al ventilatio	on with hea	t recovery	(MVHR) (22	2b)m + (23b	o) x [1 - (23	c) ÷ 100]					
	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	(24a)

Page 1

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)



URN: KCS2-A1 version 13 NHER Plan Assessor version 6.3.4 SAP version 9.92

0.28 0.27 0.27 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.26 0.26 (25)	3.24 2.92 3.24 3.13 3.24 3.13 3.24 3.13 3.24 (56)
3. Heat losses and heat loss parameter	If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] + (47), else (56)
Element Gross Openings Net area U-value A x U W/K κ-value, A x κ,	3.24         2.92         3.24         3.13         3.24         3.13         3.24         3.13         3.24         3.13         3.24         57
area, m <sup>2</sup> m <sup>2</sup> A, m <sup>2</sup> W/m <sup>2</sup> K kJ/K kJ/K	Primary circuit loss for each month from Table 3
Window 33.63 x 1.05 = 35.43 (27)	23.26         21.01         23.26         22.51         23.26         22.51         23.26         23.26         22.51         23.26         25.51         23.26         59
Exposed floor $69.47 \times 0.09 = 6.25$ (28b)	Combi loss for each month from Table 3a, 3b or 3c
External wall $122.55 \times 0.18 = 22.06$ (29a)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (61)
Party wall $38.39 \times 0.00 = 0.00$ (220)	Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m
	191.58 168.31 175.49 155.53 151.13 133.19 126.16 140.86 141.37 161.37 172.86 186.37 (62)
Roof $56.66$ x $0.18$ = $10.20$ (30)	Solar DHW input calculated using Appendix G or Appendix H
Total area of external elements $\Sigma A$ , m <sup>2</sup> 282.31 (31)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (63)
Fabric heat loss, W/K = $\Sigma(A \times U)$ (26)(30) + (32) = 73.94 (33)	Output from water heater for each month (kWh/month) (62)m + (63)m
Heat capacity $Cm = \sum (A \times \kappa)$ (28)(30) + (32) + (32a)(32e) = N/A (34)	191.58 168.31 175.49 155.53 151.13 133.19 126.16 140.86 141.37 161.37 172.86 186.37
Thermal mass parameter (TMP) in kJ/m <sup>2</sup> K (35)	$\sum_{i=1,2,3} 100.51  175.45  155.55  151.15  155.15  120.10  140.00  141.57  172.00  180.57  180.57 $
Thermal bridges: $\Sigma(L x \Psi)$ calculated using Appendix K (36)	Heat gains from water heating (kWh/month) $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$
Total fabric heat loss         (33) + (36) =         116.29         (37)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	76.09         67.15         70.74         63.70         62.64         56.28         54.34         59.22         59.00         66.04         69.47         74.36         (65)
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	5. Internal gains
29.16         28.79         28.43         26.60         26.24         24.42         24.42         24.05         25.15         26.24         26.97         27.70         (38)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Heat transfer coefficient, W/K (37)m + (38)m	Metabolic gains (Table 5)
145.45 145.08 144.72 142.89 142.53 140.71 140.71 140.34 141.44 142.53 143.26 143.99	141.04 14
Average = $\sum(39)112/12 = 142.80$ (39)	Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
Heat loss parameter (HLP), W/m <sup>2</sup> K (39)m ÷ (4)	Z4.34         Z1.62         17.58         13.31         9.95         8.40         9.08         11.80         15.84         20.11         23.47         25.02         (67)
1.31 1.31 1.30 1.29 1.28 1.27 1.27 1.26 1.27 1.28 1.29 1.30	
Average = $5(40)112/12 = 1.29$ (40)	Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
Number of days in month (Table 1a)	273.03 275.86 268.72 253.52 234.34 216.30 204.26 201.42 208.56 223.76 242.95 260.98 (68)
31.00         28.00         31.00         30.00         31.00         30.00         31.00         30.00         31.00         (40)	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
31.00 26.00 31.00 30.00 31.00 30.00 31.00 31.00 31.00 30.00 31.00 (40)	<u>37.10</u>
4. Water heating energy requirement	Pump and fan gains (Table 5a)
Assumed occupancy, N 2.82 (42)	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 (70)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	Losses e.g. evaporation (Table 5)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	-112.83 -112.8
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	Water heating gains (Table 5)
111.32         107.27         103.22         99.17         95.12         91.08         91.08         95.12         99.17         103.22         107.27         111.32	102.27         99.93         95.08         88.48         84.19         78.16         73.03         79.60         81.94         88.77         96.48         99.94         (72)
$\sum_{i=1,2,2} 10.12 = $	Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Energy content of hot water used = $4.18 \times Vd_{,m} \times nm \times Tm/3600 \text{ kWh/month}$ (see Tables 1b, 1c 1d)	464.95 462.72 446.69 420.62 393.79 368.18 351.68 358.14 371.65 397.95 428.21 451.25 (73)
	6. Solar gains
$\Sigma(45)112 = 1592.20$ (45)	Access factor Area Solar flux g FF Gains Table 6d m <sup>2</sup> W/m <sup>2</sup> specific data specific data W
Distribution loss 0.15 x (45)m	Table 6d         m <sup>2</sup> W/m <sup>2</sup> specific data         W           or Table 6b         or Table 6c         <
24.76 21.66 22.35 19.48 18.69 16.13 14.95 17.15 17.36 20.23 22.08 23.98 (46)	East 0.77 x 27.91 x 19.64 x 0.9 x 0.55 x 0.80 = 167.14 (76)
Storage volume (litres) including any solar or WWHRS storage within same vessel 1.00 (47)	
Water storage loss:	
b) Manufacturer's declared loss factor is not known	Solar gains in watts $\Sigma$ (74)m(82)m
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)	201.40 393.98 648.83 946.28 1159.70 1187.16 1130.23 970.85 754.62 467.49 251.12 165.62 (83)
Volume factor from Table 2a 4.93 (52)	Total gains - internal and solar (73)m + (83)m
Temperature factor from Table 2b 1.00 (53)	666.35         856.71         1095.53         1366.91         1553.50         1555.34         1481.91         1328.99         1126.27         865.44         679.33         616.87         (84)
Energy lost from water storage (kWh/day) (47) x (51) x (52) x (53) 0.10 (54)	7. Mean internal temperature (heating season)
Enter (50) or (54) in (55) 0.10 (55)	Temperature during heating periods in the living area from Table 9, Th1(°C) 21.00 (85)
Water storage loss calculated for each month (55) x (41)m	
URN: WPB1-A1 version 16	URN: WPB1-A1 version 16
NHER Plan Assessor version 6.3.4	NHER Plan Assessor version 6.3.4
Page 2 SAP version 9.92	Page 3 SAP version 9.92

Mean internal temp	0.97	Feb living area	<b>Mar</b> a n1,m (se	Apr e Table 9a)	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temp	0.97												
Mean internal temp			0.89	0.79	0.65	0.50	0.39	0.44	0.66	0.87	0.95	0.97	(86)
Temperature during								••••			0.00		_ (/
Temperature during	18.28	18.67	19.28	20.00	20.52	20.82	20.93	20.91	20.64	19.87	18.94	18.21	(87)
							20.00	20.51	20101	15.07	10101	10.21	_ (0.7
	19.83	19.84	19.84	19.85	19.85	19.87	19.87	19.87	19.86	19.85	19.85	19.84	(88)
Utilisation factor for					15.05	15.07	15.67	15.67	15.00	15.05	19.05	15.04	_ (00)
	0.96	0.93	0.87	0.76	0.60	0.43	0.30	0.35	0.59	0.84	0.94	0.97	(89)
 Mean internal temp								0.55	0.55	0.04	0.54	0.57	_ (05)
	16.22	16.78	17.66	18.65	19.34	19.71	19.83	19.81	19.52	18.52	17.18	16.13	(90)
Living area fraction	10.22	10.70	17.00	10.05	15.54	15.71	15.65	15.01		ving area ÷		0.45	(91)
Mean internal temp	erature f	or the who	le dwellin	⊽ fl A x T1 +	(1 - fl A) x	т2			LI	ving area .	(4) -	0.45	_ (51)
	17.15	17.63	18.39	19.26	19.87	20.21	20.32	20.30	20.02	19.13	17.97	17.07	(92)
Apply adjustment to								20.30	20.02	19.13	17.97	17.07	_ (92)
	17.15	17.63	18.39	19.26	19.87	20.21	20.32	20.30	20.02	19.13	17.97	17.07	(93)
	17.15	17.05	10.59	19.20	19.87	20.21	20.52	20.50	20.02	19.15	17.97	17.07	_ (93)
8. Space heating re	equireme	nt											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for	gains, ηr	n											
	0.94	0.91	0.85	0.74	0.60	0.46	0.34	0.38	0.60	0.82	0.92	0.95	(94)
Useful gains, ηmGm	, W (94)r	m x (84)m											_
6	29.67	779.35	925.83	1007.18	935.26	708.49	496.93	509.65	675.52	707.78	625.42	587.72	(95)
Monthly average ex	ternal ter	nperature	from Table	e U1							-		_
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for m	ean interi	nal temper	ature, Lm	W [(39)m	x [(93)m -	(96)m]							_
18	368.49	1846.58	1720.27	1480.04	1164.42	789.51	523.86	547.60	837.64	1215.64	1557.26	1852.91	(97)
Space heating requi	rement, k	Wh/mont	h 0.024 x	[(97)m - (95	5)m] x (41)	m							_
9	21.68	717.18	591.06	340.45	170.50	0.00	0.00	0.00	0.00	377.85	670.93	941.31	٦
		•							Σ(9)	8)15, 10	.12 =	1730.96	(98)
Space heating requi	rement k	Wh/m²/ye	ar							(98)	÷ (4)	42.61	(99)
9b. Energy require	ments - c	ommunity	heating s	cheme									
Fraction of space he	at from s	econdary/	supplemen	ntary system	m (table 11	.)				'0' if ı	none	0.00	(301
Fraction of space he	at from c	ommunity	system							1 - (30	01) =	1.00	(302
Fraction of commun	ity heat f	rom boiler	s									0.30	(303
Fraction of commun	ity heat f	rom CHP										0.70	(303
Fraction of total spa	ce heat fr	rom comm	unity CHP							(302) x (30	3a) =	0.70	(304
Fraction of total spa	ce heat fr	rom comm	unity boile	ers						(302) x (303	3b) =	0.30	(304
Factor for control ar	nd chargir	ng method	(Table 4c(	3)) for com	imunity spa	ace heating						1.00	(305
Factor for charging I	method (1	Table 4c(3)	) for comr	nunity wate	er heating							1.00	(305
Distribution loss fac	tor (Table	12c) for c	ommunity	heating sy	stem							1.05	(306
6 h'													
Space heating								· · ·	720.65	1			1
Annual space heatin	· ·	ment							730.96				(98)
Space heat from CH										x (305) x (30		3477.25	(307
Space heat from boi	lers							(98	8) x (304b) :	x (305) x (30	06) = [	1490.25	(307

#### Water heating Annual water heating requirement Water heat from CHP Water heat from boilers Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = Electricity for pumps, fans and electric keep-hot (Table 4f) mechanical ventilation fans - balanced, extract or positive input from outside Total electricity for the above, kWh/year Electricity for lighting (Appendix L) Energy saving/generation technologies electricity generated by PV (Appendix M) Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =10b. Fuel costs - community heating scheme Fuel kWh/year 3477.25 Space heating from CHP х 1490.25 Space heating from boilers Water heating from CHP 1399.60 х Water heating from boilers 599.83 Pumps and fans 208.85 Electricity for lighting 429.86 Additional standing charges Energy saving/generation technologies -418.27 pv savings Total energy cost 11b. SAP rating - community heating scheme Energy cost deflator (Table 12) Energy cost factor (ECF)

0.42	(356
1.18	(357
83.56	
84	(358
В	

(64)

(310a)

(310b)

(313)

(330a)

(331)

(332)

(333)

(338)

(340a)

(340b)

(342a)

(342b)

(349)

(350)

(351)

(352)

(355)

1399.60

599.83

69.67

208.85

429.86

-418.27

7187.38

Fuel

cost £/year

103.27

63.19

41.57

25.43

27.55

56.70

120.00

0.00

437.71

1904.22

208.85

Fuel price

2.97

4.24

2.97

4.24

13.19

13.19

13.19

(340a)...(342e) + (345)...(354) =

x 0.01 =

(64) x (303a) x (305a) x (306) =

(64) x (303b) x (305a) x (306) =

## 12b. CO<sub>2</sub> emissions - community heating schem

SAP value SAP rating (section 13) SAP band

		Energy		Emission factor		Emissions	
		kWh/year				(kg/year)	
Emissions from community CHP (space	e and water heating)						
Power efficiency of CHP unit		31.50					(361)
Heat efficiency of CHP unit		48.50					(362)
Space heating from CHP	(307a) × 100 ÷ (362) =	7169.0134	х	0.2160	=	1548.5069	(363)
less credit emissions for electricity		-2257.9570	х	0.5190	=	-1171.8797	(364)
Water heated by CHP		2885.5458	х	0.2160	=	623.2779	(365)
less credit emissions for electricity	[	-908.8333	х	0.5190	=	-471.6845	(366)
Emissions from other sources (space h	eating)						
Efficiency of boilers	[	91.80					(367b)
CO2 emissions from boilers [(307	b)+(310b)] x 100 ÷ (367b) = [	2276.78	х	0.216	=	491.78	(368)
Electrical energy for community heat of	distribution	69.67	х	0.519	=	36.16	(372)

SAP version 9.92

URN: WPB1-A1 version 16 NHER Plan Assessor version 6.3.4 SAP version 9.92

Total CO2 associated with community systems					1056.16	(373)
Total CO2 associated with space and water heating					1056.16	(376)
Pumps and fans	208.85	х	0.519	=	108.39	(378)
Electricity for lighting	429.86	х	0.519	=	223.10	(379)
Energy saving/generation technologies						
pv savings	-418.27	х	0.519	=	-217.08	(380)
Total CO <sub>2</sub> , kg/year				(376)(382) =	1170.57	(383)
Dwelling CO₂ emission rate				(383) ÷ (4) =	10.54	(384)
El value					89.95	]
El rating (section 14)					90	(385)
El band					В	]

#### 13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)
Primary Energy from community CHP (space and water heating)					
Power efficiency of CHP unit	31.50				(361)
Heat efficiency of CHP unit	48.50				(362)
Space heating from CHP $(307a) \times 100 \div (362) =$	7169.01	x	1.22	=	8746.20 (363)
less credit energy for electricity	-2257.96	x	3.07	=	-6931.93 (364)
Water heated by CHP	2885.55	x	1.22	=	3520.37 (365)
less credit energy for electricity	-908.83	x	3.07	=	-2790.12 (366)
Primary energy from other sources (space heating)					
Efficiency of boilers	91.80				(367b)
Primary energy from boilers [(307b)+(310b)] x 100 ÷ (367b) =	2276.78	x	1.22	=	2777.67 (368)
Electrical energy for community heat distribution	69.67	x	3.07	=	213.89 (372)
Total primary energy associated with community systems					5536.07 (373)
Total primary energy associated with space and water heating					5536.07 (376)
Pumps and fans	208.85	x	3.07	=	641.15 (378)
Electricity for lighting	429.86	x	3.07	=	1319.68 (379)
Energy saving/generation technologies					
Electricity generated - PVs	-418.27	x	3.07	=	-1284.09 (380)
Primary energy kWh/year					6212.81 (383)
Dwelling primary energy rate kWh/m2/year					55.96 (384)

# BRUKL Output Document MGovernment

Compliance with England Building Regulations Part L 2013

Project name

## Notting Hill Gate Office - Be Green

As designed

Date: Fri May 18 10:34:49 2018

## Administrative information

Building	Details
Address:	Address 1, City, Postcode

## Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.6
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.6
BRUKL compliance check version: v5.2.g.3

Owner Details Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Certifier details Name: Name Telephone number: Phone Address: Street Address, City, Postcode

Criterion 1: The calculated CO<sub>2</sub> emission rate for the building should not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	21.5
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	21.5
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	13.4
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	Ua-Limit		Ui-Calc	Surface where the maximum value occurs*				
Wall**	0.35	0.25	0.25	1F000000:Surf[1]				
Floor	0.25	0.16	0.16	1F000000:Surf[0]				
Roof	0.25	0.16	0.16	2F000001:Surf[0]				
Windows***, roof windows, and rooflights	2.2	1.1	1.1	1F000000:Surf[2]				
Personnel doors	2.2	-	-	No Personnel doors in building				
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building				
High usage entrance doors	3.5	-	-	No High usage entrance doors in building				
U+Limit = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] U+cate = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] U+cate = Calculated maximum individual element U-values [W/(m <sup>2</sup> 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
m³/(h.m²) at 50 Pa	10	3

URN: WPB1-A1 version 16 NHER Plan Assessor version 6.3.4 SAP version 9.92

### **Building services**

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- FCU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency				
This system	0.96	4.5	0	1.6	0.75				
Standard value	0.91*	3.2 N/A 1.6 <sup>^</sup> 0.5							
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES									

\* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

<sup>a</sup> Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

#### 1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	105	0.34
Standard value	105	0.2

#### Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	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
Е	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
Н	Fan coil units
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(I/s)]									
ID of system type	Α	в	С	D	Е	F	G	н	1	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
GF - Office Reception W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
1F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A

Zone name	SFP [W/(I/s)]										
ID of system type	Α	в	С	D	E	F	G	н	1	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
2F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
2F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office W	-	-	-	-	-	-	-	0.2	-	-	N/A
3F - Office Circulation	-	-	-	-	-	-	-	0.2	-	-	N/A

General lighting and display lighting	Lumino	acy [lm/W]	]	
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
1F - Office W	100	-	-	1562
2F - Office W	100	-	-	1562
3F - Office W	100	-	-	1562
GF - Office Circulation	-	100	-	91
GF - Office Reception W	-	100	70	741
1F - Office Circulation W	-	100	-	52
1F - Office W	100	-	-	1025
1F - Office Circulation	-	100	-	50
1F - Office W	100	-	-	418
1F - Office Circulation W	-	100	-	30
1F - Office Circulation	-	100	-	125
1F - Office	100	-	-	284
2F - Office Circulation W	-	100	-	52
2F - Office Circulation W	-	100	-	30
2F - Office Circulation	-	100	-	125
2F - Office	100	-	-	284
2F - Office W	100	-	-	1025
2F - Office W	100	-	-	418
2F - Office Circulation	-	100	-	50
3F - Office Circulation W	-	100	-	52
3F - Office Circulation W	-	100	-	30
3F - Office Circulation	-	100	-	125
3F - Office	100	-	-	284
3F - Office W	100	-	-	1025
3F - Office W	100	-	-	418

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
3F - Office Circulation	-	100	-	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?
1F - Office W	NO (-63.9%)	YES
2F - Office W	NO (-56.7%)	YES
3F - Office W	NO (-60.7%)	YES
GF - Office Circulation	NO (-93.1%)	NO
GF - Office Reception W	NO (-22.3%)	YES
1F - Office Circulation W	NO (-58.2%)	YES
1F - Office W	NO (-56.8%)	YES
1F - Office Circulation	NO (-97.3%)	NO
1F - Office W	NO (-57.7%)	YES
1F - Office Circulation W	NO (-37.3%)	YES
1F - Office Circulation	NO (-98.2%)	NO
1F - Office	NO (-98.8%)	NO
2F - Office Circulation W	NO (-58.2%)	YES
2F - Office Circulation W	NO (-37.4%)	YES
2F - Office Circulation	NO (-98.1%)	NO
2F - Office	NO (-98.8%)	NO
2F - Office W	NO (-53.6%)	YES
2F - Office W	NO (-57.5%)	YES
2F - Office Circulation	NO (-97.2%)	NO
3F - Office Circulation W	NO (-58.1%)	YES
3F - Office Circulation W	NO (-36.4%)	YES
3F - Office Circulation	NO (-98%)	NO
3F - Office	NO (-98.7%)	NO
3F - Office W	NO (-51.5%)	YES
3F - Office W	NO (-56.7%)	YES
3F - Office Circulation	NO (-97.2%)	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 proces	ss? YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

## Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters				
	Actual	Notional	% Are	
Area [m²]	2367.6	2367.6		
External area [m²]	2554.6	2554.6		
Weather	LON	LON	100	
Infiltration [m³/hm²@ 50Pa]	3	3		
Average conductance [W/K]	1320.6	1374.19		
Average U-value [W/m <sup>2</sup> K]	0.52	0.54		
Alpha value* [%]	10	10		
<u> </u>				

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

ldi	ing Use
_	
ea	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
	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

ŀ	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2		Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	47.8	40.6	15.3	2.6	11.3	0.87	4.34	0.96	5.5

Rey to terms	
Heat dem [MJ/m2]	
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 to terms

## Energy Consumption by End Use [kWh/m<sup>2</sup>]

	Actual	Notional
Heating	15.34	13.19
Cooling	2.6	5.06
Auxiliary	11.92	15.62
Lighting	5.85	15.18
Hot water	10.81	2.2
Equipment*	31.57	31.57
TOTAL**	42.81	51.26

\* 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/m<sup>2</sup>]

	Actual	Notional
Photovoltaic systems	1.44	0
Wind turbines	0	0
CHP generators	3.71	0
Solar thermal systems	0	0

## Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	88.47	110.01
Primary energy* [kWh/m <sup>2</sup> ]	82.43	126.14
Total emissions [kg/m <sup>2</sup> ]	13.4	21.5

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

## Key Features

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

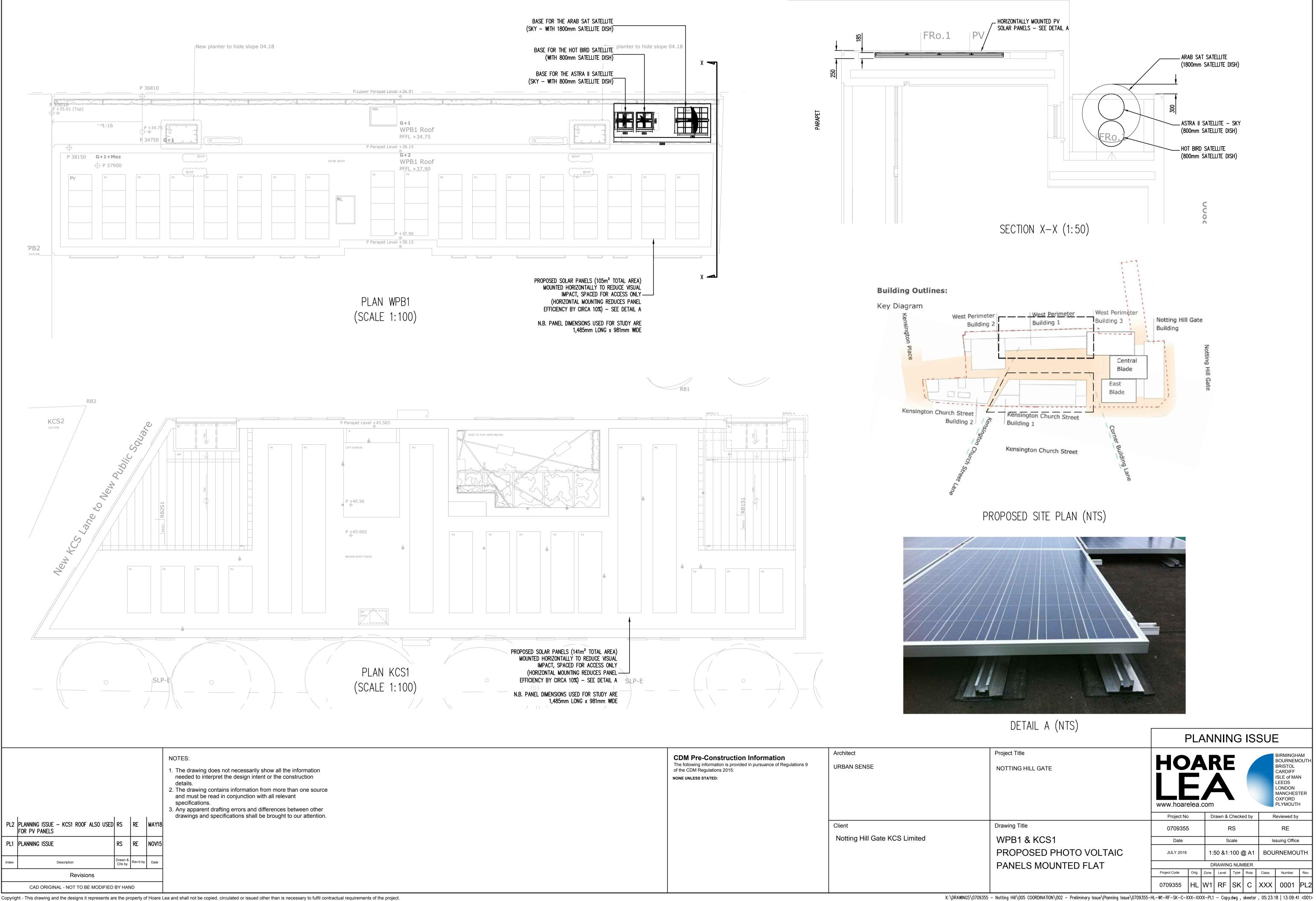
## Building fabric

Element	U <sub>i-Typ</sub>	Ui-Min	Surface where the minimum value occurs*	
Wall	0.23	0.25	1F000000:Surf[1]	
Floor	0.2	0.16	1F000000:Surf[0]	
Roof	0.15	0.16	2F000001:Surf[0]	
Windows, roof windows, and rooflights	1.5	1.1	1F000000:Surf[2]	
Personnel doors	1.5	-	No Personnel doors in building	
Vehicle access & similar large doors	15	-	No Vehicle access doors in building	
High usage entrance doors	1.5	-	No High usage entrance doors in building	
U <sub>LTyp</sub> = Typical individual element U-values [W/(m <sup>2</sup> K)] U <sub>LMin</sub> = Minimum individual element U-values [W/(m <sup>2</sup> K)]				
* There might be more than one surface where the	minimum l	J-value oc	curs.	

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

**APPENDIX 7 - ROOF LAYOUT** 

Energy Strategy Addendum



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