
Norcot Community Centre Reading

Building Services Engineering Design Description

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Issue: 1

Date: 26th August 2020

Project: C1530

NORCOT COMMUNITY CENTRE, READING**CONTENTS:****DESIGN DESCRIPTION**

Revision	Date	Description	Revised	Checked
1	26/08/20	Issued for information		AJW

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1.0 INTRODUCTION

The purpose of this document is to provide the client with a brief description of the mechanical and electrical systems required and considers the energy usage of the community centre and the low carbon and sustainable energy solutions available.

Our proposals are based on the requirements set out within the Employers Requirement Document Version 3 2019 (ERs) and the findings arising from Design Stage Part L calculations. Options will be considered further with the client and end users at detailed design stage.

2.0 PROJECT DESCRIPTION

The development is located at Norcot Community Centre, Lyndhurst Road, Reading RG30 6UB.

The works comprise the design and construction of a new three storey block of 18 flats comprising 8 No one bedroom apartments, 10 No two bedroom apartments and ancillary landlords spaces. A new build community centre and ancillary space adjoins the residential development.

Reading Borough Council have produced Employers requirements which outline the mechanical and electrical services requirements for the development, alongside the improvement in energy efficiency standard required. Where M&E services systems have not been defined within the employers requirements this document recommends systems available in accordance with the clients aspirations.

3.0 DESIGN STANDARDS

The following list provides the general basis for design development, it should not be regarded as exhaustive;

- i) BRE and BSRIA Technical Publications.
- ii) Building Regulations
- iii) Local Authority's Bylaws and Regulations
- iv) Local Authority's Sustainable Design and Construction Guidance SPG
- v) Water Authority's Bylaws
- vi) Electrical Supply Authority's requirements
- vii) The Gas Safety Regulations
- viii) The requirements of the Environmental Protection Act and the local Environmental Health Officer
- ix) Appropriate British Standard Specification and Codes of Practice and the Standards of the International Electrotechnical Commission (IEC)
- x) Regulations for Electrical Installations (IEE Wiring Regulations) Current Edition including all current amendments
- xi) Health and Safety at Work Act, Shops and Offices Act and Electricity at Work Regulations
- xii) CIBSE Guides, Codes and Technical Memoranda.
- xiii) CDM Regulations
- xiv) Manufacturer's stipulations & recommendations for installing & testing
- xv) The COSHH Regulations
- xvi) The Employer's Insurer's
- xvii) HVCA standards publications
- xviii) The Employers Requirements

4.0 ENERGY AND ENVIRONMENTAL ISSUES

4.1 INTRODUCTION

This section considers the energy efficiency and renewable energy options available and reviews each systems suitability against capital cost, carbon emissions, life cycle costs and energy costs.

Various energy-saving measures have been considered both in terms of technical and economic feasibility and their effect on any carbon dioxide emissions. A broad package of energy-saving measures is proposed and is described in more detail in the following sections.

4.2 BASELINE EMISSIONS

The proposed newbuild development falls under current building regulations requirements 2013 and must comply with both building regulations approved document L1A 'Conservation of fuel and power in new dwellings' and document L2A 'Conservation of fuel and power in new buildings other than dwellings'. Part L1A covering the residential area of the development and Part L2A covering the community hall and its ancillary spaces.

The methodology for computing CO₂ emissions is via the Governments SAP and iSBEM assessment calculation procedures using accredited software. Both calculations have been undertaken to inform design making in respect of the engineering solutions and to ensure compliance with the governments Target CO₂ emissions Rating (TER).

Both calculations must adhere to Reading Borough Councils Employers Requirements document Version 3 2019 (ERs) which states a minimum of 35% reduction in energy efficiency over building regulations:

"Improvement in energy efficiency standard

The Contractor shall comply with Reading Borough Council's Planning Policy Requirement CS1 that the development is to achieve an energy efficiency standard of a minimum of 35% CO₂ improvement over Building Regulations requirements Part L 2013 Edition with 2016 Amendments (Target Emission Rate Baseline).

The Council strategy is to achieve Zero Carbon for fuel usage.

The Contractor will provide SAP and other documentary evidence to show the achievement of 35% CO₂ improvement over Building Regulations for all sites."

As an approved assessor HWM have undertaken both L1 (SAP) and L2 (SBEM) calculations to help inform decisions on building fabric and building services systems to ensure compliance is achieved.

4.3 ENERGY DEMAND

Good low carbon design starts with good building design, low carbon and renewable technologies should only be considered once the development has maximised its energy saving potential.

Proposed developments should consider the following energy saving measures to limit energy demand prior to incorporating renewable technologies;

- Excellent thermal performance of the building envelope
- Efficient 'air tight' structure
- Efficient hot water and heat generation plant
- Natural ventilation where applicable

- Energy efficient lighting and controls
- User friendly energy efficient controls
- Consider the thermal mass of the building
- Building orientation to minimise adverse impact of environmental noise, excess heat gain and to maximise advantageous impact daylighting, fortuitous energy gains and visual comfort to users
- Low embodied energy materials

These energy efficiency measures have been considered and will be incorporated into our design proposals wherever possible and where technically and economically feasible.

4.4 RENEWABLE ENERGY SOLUTIONS

What constitutes renewable energy is defined by the Government through the Department for Communities and Local Government and is as follows:

- Wind Power
- Solar
- Hydro
- Biomass
- Combined Heat and Power (CHP)
- Ground source Heat Pumps
- Air source Heat Pump

Wind Power



Harnessing wind energy is possible with roof mounted turbines or ground mounted units.

A wind turbine converts the energy of wind into kinetic energy to drive a generator which in turn creates electricity, electricity can then be used at source or exported back to the grid thus taking advantage of the Governments feed in tariff scheme.

Wind turbines in locations with constantly high wind speeds bring the best return on investment.

Wind speed investigations can be undertaken but it is unlikely that the site will prove to be adequate. Also due consideration has to be given to the locality and a wind turbine in this residential area will prove to be detrimental to current aesthetics and may give rise to noise complaints.

Solar



Solar energy can be harnessed in a number of ways.

The orientation of the building can be optimised to;

- Harness fortuitous heat gains in winter to reduce heating energy
- Maximise the use of daylight and reduce energy consumed by artificial lighting
- Minimise solar overheating in summer to reduce cooling energy

The building can also be provided with solar collectors, in the form of photovoltaic panels and solar thermal panels for generating electricity and hot water for heating and hot water generation respectively.

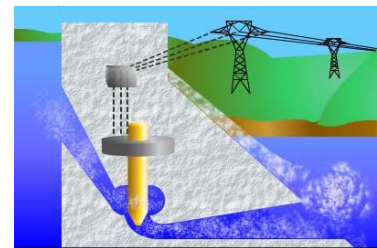
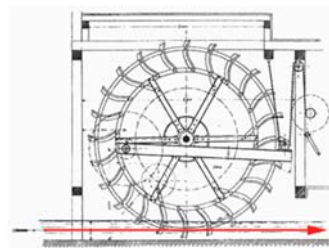
Solar electricity systems capture the sun's energy using photovoltaic (PV) cells. The cells convert the sunlight into electricity, which can be used to power appliances and lighting. It would also be possible to provide power to a ground or air source heat pump.

Solar thermal panels are effective and could be proposed to assist in the production of domestic hot water. The use of a solar panel array depends on the roofscape of the building sufficiently sized to accommodate the panels together with other plant and equipment. Solar panels could be utilised located on the South facing roofs.

A photovoltaic array located on the roof is a viable option for the development both for the residential and community building.

Solar thermal for the use of hot water generation is not a viable option due to the use of the development.

Hydro



Should the site be adjacent to a water course that has a drop in excess of 2-3m then a hydro scheme could be investigated. It is not an option for this project.

Biomass



The use of a biomass source burned to produce thermal energy is seen to be carbon neutral.

Biomass can be consumed from several sources, waste, wood chip and wood pellet. Of these wood pellet is commercially the most effective for projects in urban locations. The fuel can be delivered by tanker and pneumatically delivered into storage. Further, its calorific value is high, moisture content and chemical content is managed.

Wood chips are most commonly produced by chipping the waste timber and bark from newly felled trees and during routine thinning and maintenance. Short rotation coppice is an alternative source of wood chips where fast-growing trees such as willow are grown as fuel crop. The chips are dried naturally before use. The size of the chips can vary considerably.

In contrast wood pellets are a manufactured product, most commonly made from the saw-dust of saw mills. They are manufactured to close tolerances of size and moisture content. Preliminary discussions with suppliers indicate that secure supplies are available locally.

Biomass boilers operate on a limited turndown ratio of approximately 25%. They need a constant load to operate efficiently such as a thermal store or a high hot water demand.

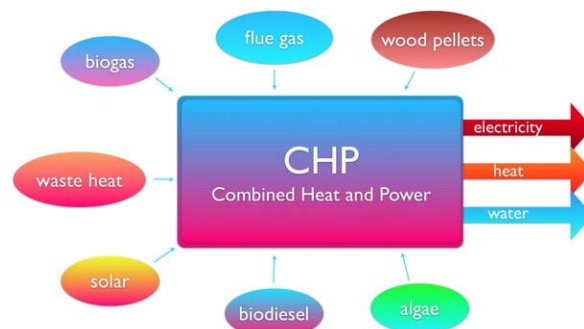
Underfloor heating in winter would provide a sufficient steady load, water heating however would be intermittent year round.

The implementation of a biomass boiler would require significant central plant space, large fuel store and regular wood pellet deliveries. The plants operation and regular ongoing maintenance would require management.

Although the burning of biomass is seen as carbon neutral the system still has a carbon footprint associated with its implementation due to the embodied carbon within the plant, the ongoing maintenance and delivery of biomass through transportation emissions.

Biomass is discounted for the above reasons.

Combined Heat and Power (CHP)



Combined heat and power is the site generation of electricity and the site use of the associated waste thermal energy. Electricity generation is selected against the building base load to maximise running hours. Thermal energy could be used for winter heating and domestic hot water generation.

The use of combined heat and power is recognised in the renewables sector. Whilst the energy source is not generally renewable, gas or oil, the overall performance improves the efficiency of power generation over grid supplied electricity from approximately 40% to 70% saving energy and reducing carbon emissions at source.

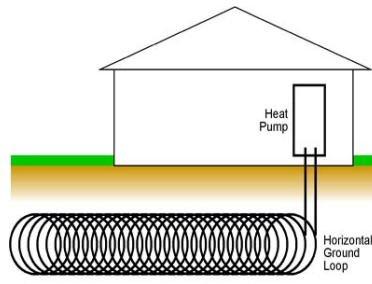
CHP plant relies on a stable, constant heat load to make maximum use of the thermal energy created. Without a constant load to heat, the waste thermal energy would be rejected into the atmosphere thus dramatically reducing the plants energy efficiency.

CHP plant in excess of 100kW (Thermal) is an attractive solution due to the low capital cost to the client. The client enters into an agreement with the CHP provider contracting to buy electricity from the supplier at an agreed tariff, the CHP supplier will provide and maintain the plant at their own costs.

The thermal load for our site will not reach the size where the supplier will fund the scheme also there is currently no permanent heat load, the CHP plant requires a large central plant area and

can be noisy, therefore for these reasons and with its high initial capital cost CHP is discounted.

Ground Source Water



Ground source water offers a more practical range of solutions.

Closed loop systems, where pipes are buried in the ground either linked with piles or bores or in a slinky arrangement, provide an energy source for a heat pump system. The heat pump system can then provide cooling in the summer and heating in the winter.

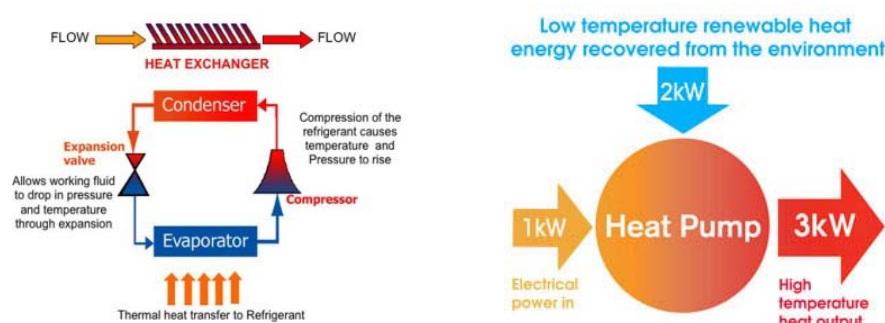
Open loop systems abstract water from bore holes and utilise its energy carrying capability as the closed loop system. The abstracted water can either be returned to the ground or to waste.

A further potential benefit is the use of bore hole water (private water supply) for domestic usage, producing savings against water charges. This is optimum rain water recycling.

The primary energy source for all of these systems is electricity, however because of stable ground temperatures coefficient of performance, particularly in winter, are enhanced against air source heat pumps.

A closed loop ground source heat pump solution is not a viable option for this project due to the area of pipework required to be installed below the ground and the central plant area required to host the plant.

Air Source Heat Pump



Air source heat pumps are recognised as a renewable energy source by the European performance directive.

A heat pump is a device for transferring heat from a lower temperature heat source to a higher temperature heat sink. This is opposite to the natural flow of heat from a hot source to a cold sink, but is made possible by the application of an external energy source to drive a thermodynamic refrigeration cycle. The important characteristics of a heat pump is that the amount of heat that can be transferred is greater than the energy needed to drive the cycle.

Air source heat pumps absorb heat from the outside air. This heat can then be used to warm water for radiators or underfloor heating systems, or to warm the air in buildings.

Air source heat pumps rely on the latent heat energy in the air, whilst seasonal C.O.P.'s of 2.5-3.0 are achievable C.O.P.'s can drop considerably at lower external ambient temperatures. A typical seasonal C.O.P. of 2:1 is normal.

Air source heat pumps have a lower capital cost, are easy to install and are considerably less intrusive at installation stage than Ground source heat pumps making them ideal solutions for smaller developments with limited space and refurbishment projects. The latter however offers more stable winter performance and better C.O.P.'s.

Air source heat pumps are a viable heating and hot water solution, however positioning of the external condensers and the noise output associated must be considered also the system will require significant plant space both externally and internally.

Due to the above reasons an air source heat pump solution is discounted for the residential scheme but is an option for the community centre.

4.5 CONCLUSION

The previous sections have discussed the various energy and renewable options available and have highlighted the advantages and disadvantages of each system as applicable to the project. The site offers two main options with regards to implementing renewable technologies as previously reviewed, photovoltaics for the residential and Community building and air source heat pump for the community building alone.

The employers requirements are specific in their request for low building fabric u-values, gas fired boilers, MVHR units and Photovoltaics in the residential flats. The community building however is not covered in the employers requirement document.

Design stage SAP calculations based on the employers requirements have been undertaken and the calculations confirm that compliance with 35% reduction against the target emission rating (TER) can be met. To achieve the above requires 13.58kWp of PV which equates to 47 panels which can be accommodated on the flat roof.

See Appendix A for SAP calculations results.

A similar design philosophy of low building fabric u-values, gas fired boiler for heating and hot water generation, natural ventilation and Photovoltaics is proposed for the Community building. A design stage iSBEM calculation based on the above proves compliance with 35% reduction against the target emission rating (TER) can be met. To achieve the above requires 2.03kWp of PV which equates to 7 panels which can be accommodated on the flat roof.

Substituting the gas fired boiler with an air source heat pump makes little difference to the final emission rating so has been discounted for this reason.

See Appendix B for iSBEM calculation results.

The PV systems will serve both the residential area of the development and also the communal hall and its ancillary spaces. A total of 53 panels will be required, situated on the residential roof facing South West. By incorporating this PV system into the development, the 35% reduction can be achieved.

The mechanical and electrical engineering services i.e. heating, hot water, ventilation, lighting, power and data to name but a few will be developed alongside the building design in a holistic approach. Our intention is to provide a low carbon, energy efficient building that treads lightly enough today for future generations of tomorrow.

5.0 INCOMING SERVICES**5.1 GAS**

Two new incoming gas supplies shall be provided from the existing infrastructure to the development.

One supply shall tee off to rise in each of the bin stores and will serve 9 meters in each bin store located at high level. Each flat will be individually fed from the meters in the bin stores.

The community centre will be individually fed from a meter located in an external meter box adjacent to the entrance.

5.2 WATER

Four new incoming mains water supplies shall be provided from the existing infrastructure to the development. One supply shall serve all of the flats via individually metered supplies, one supply shall serve the community area and one shall serve the landlords area.

A separate unmetered fire supply will serve the residential sprinkler system subject to a pressure test on the existing mains water supply in Lyndhurst Road.

An existing fire hydrant exists adjacent to the entrance of the site within 90m of the main entrance.

All water supply terminations will meet the requirements of the Water Regulations.

5.3 ELECTRICITY

The local LV network shall be extended on to the site by the DNO to provide the following;

- 18 No single phase supplies to flats
- 2 No single phase landlords supplies
- 1 No single phase supply to the Community Centre

The DNO will provide a new LV service to each apartment block riser core and provide an MSDB in each apartment block riser at ground floor level. Supplies will emanate from the MSDB's to individual meters located in the riser of the floor of the flat that they serve.

The site's existing power supply will be evaluated to ascertain if there is sufficient spare capacity to feed the new development. Should the new building require more load than is available then the existing supply will be upgraded to suit.

5.4 TELECOMMUNICATIONS AND DATA

The Contractor shall engage Openreach to provide the building telephone requirements. Openreach shall provide a network termination point within each apartment block riser and the Community Centre.

An underground ducted system shall be provided to accommodate Openreach's requirements.

Telephone lines shall be applied for as required by the Employer Requirement document.

6.0 MECHANICAL SERVICES

The Employers Requirements document provides information on the mechanical and electrical systems for the residential area of the development, however provides little information as to the requirements for the community hall and its ancillary spaces.

Below is a description of the Mechanical services systems proposed for the new developments.

6.1 HEATING**Residential Areas**

Within the flats, heating shall be afforded via wall mounted radiators. Each radiator will have a thermostatic radiator valve providing local control.

Primary heat will be afforded to the radiator system by a gas fired combination boiler located within the Kitchen. The combination boiler will also provide hot water to all required outlet points.

Landlords areas will be unheated.

Community Centre

Within the community hall and its ancillary spaces, heating shall be afforded by an underfloor heating system fed via a gas fired combination boiler. The combination boiler shall also provide hot water to all required outlet points.

6.2 HOT AND COLD WATER SERVICES**Residential Areas**

A new mains water supply will be provided to the residential area to serve all 18 flats. The supply will be routed below ground to a riser in each blocks central core.

The common rising mains water supply will serve a manifold on each floor level, the manifold will in turn provide individual metered supplies to serve each flat on that particular floor. All meters will be free issued by Thames Water complete with remote readers that can be read from outside of the building.

Each incoming mains water supply shall be complete with an in-line electrolytic scale inhibitor.

Hot water generation to each flat will be via the gas fired combination boiler located within the Kitchen.

An unmetered fire sprinkler supply will feed the residential sprinkler systems from a riser in each core. The unmetered sprinkler supply is subject to a flow and pressure test to determine of the mains water supply will be adequate.

Community Centre

A new metered mains water supply will be provided to the community centre to serve all required outlets at mains pressure.

The incoming mains water supply will be complete with an in-line electrolytic scale inhibitor.

Hot water generation will be via the gas fired combination boiler.

Landlords

A new metered mains water supply will be provided to the landlords areas to serve a lockable hose union bib tap with suitable backflow protection within each of the bin stores.

6.3 VENTILATION**Residential Areas**

Ventilation will be provided to the following areas within the flats as defined below:

Area	Requirements	Control
Bedrooms	Mechanical Ventilation Heat Recovery (MVHR) - Supply	Continuous
Lounge	Mechanical Ventilation Heat Recovery (MVHR) - Supply	Continuous
Kitchens	Mechanical Ventilation Heat Recovery (MVHR) - Extract	Continuous with boost switching via local switch or local humidistat
Bathrooms	Mechanical Ventilation Heat Recovery (MVHR) - Extract	Continuous with boost switching via light switch or local humidistat

Each flat shall have an MVHR unit located at high level within the cupboard providing whole house ventilation. The Bedrooms and Lounge will be afforded mechanical supply ventilation and the Kitchen and Bathrooms shall be afforded mechanical extract ventilation.

The MVHR unit will run continuously with a boost facility provided to both the Kitchen and the Bathroom via local or lighting control or a wall mounted humidistat.

Community Hall

Ventilation will be provided to the following areas within the community hall and its associated areas as defined below:

Area	Requirements	Control
WC	Mechanical Extract Passive Supply	Local on/off via lighting PIR
Utility Room	Mechanical Extract Passive Supply	Local on/off via lighting PIR
Community Hall	Natural	Manual control

The WC and Utility Room shall have independent local mechanical extract with passive make up air from adjacent spaces via undercut doors where applicable. Control shall be on/off with a run on via the individual room lighting PIR.

The Community Hall shall be naturally ventilated via openable windows and trickle vents.

6.4 ABOVE GROUND WASTE DISPOSAL

A fully vented system of above ground waste disposal pipework will be provided to serve all sanitary appliances. Main vertical stacks will be installed in uPVC pipework.

The above ground drainage system will connect to the below ground drainage system, the below ground drainage system will be designed by others.

6.5 GAS**Residential Areas**

The incoming gas supply serving the residential area shall split and rise within each of the Bin Stores where individually metered supplies will feed the combination boilers and valved and capped bayonet fittings for a future cooker/hob off within each flat.

Community Hall

The incoming gas supply serving the Community Centre and its associated areas shall rise within the Store before serving the combination boiler.

It is not proposed to provide gas for cooking in the Community Centre.

7.0 ELECTRICAL SERVICES

7.1 LV DISTRIBUTION

The DNO will establish an MSDB in each riser core as follows:

Reference	Serving	Location	Rating
Core 01	9 No Flats 1 No Landlords	Flat Riser	100A SP&N 100A SP&N
Core 02	9 No Flats 1 No Landlords	Flat Riser	100A SP&N 100A SP&N
Community Centre	1 No Community Centre	Store	100A SP&N

The DNO will terminate each supply with a 100A cut-out.

Residential

From the MSDB in the riser DNO cables will rise up to each level and feed off to the flats. The DNO service cable will terminate within the flat store cupboard with a cut-out where the DNO installation will terminate. Final suitability and location of the cut-out in apartment shall be agreed with the client.

Metering will be by smart meters located in the flat adjacent to the cut-out and then from the meter to a consumer unit.

Landlords

From the MSDB in the riser DNO cables shall terminate with a cut-out adjacent the MSDB.

Metering will be by a smart meter located in the riser adjacent to the cut-out and then from the meter to the landlords distribution board adjacent the meter position in the riser.

Community Centre

DNO cables shall terminate with a cut-out in the store room.

Metering will be by a smart meter located in the store adjacent to the cut-out and then from the meter to the Community Centre distribution board adjacent the meter.

7.2 WIRING

Wiring will be concealed within the building fabric and distributed along galvanised cable tray where appropriate utilising 6242YH twin and earth cabling. Where circuits are required externally these will be provided via 6491 single core cables installed in conduit or trunking, or XLPE/SWA cables where installed underground.

7.3 SMALL POWER

All power supplies, outlets and connections as necessary to facilitate the electrical and mechanical installations and as required by the Employers Requirements.

All 13A socket outlets shall be protected via RCD devices.

The landlords communal areas will be provided with socket outlets for cleaning purposes on each floor level. Socket outlets within the communal areas shall be provided with a lockable key operated switch to prevent unauthorised use.

Circuits shall be ring or radial type, and all 13A sockets shall be protected via RCD devices.

All outlets and switches shall be of the flushed brushed stainless steel type, except within risers and areas where a surface installation is required. Surface metal clad outlets are to be provided to bin stores.

All fused connection units shall be provided with switches and cartridge fuses. Unless stated otherwise. The fire alarm and AOV supply shall be provided via a fused connection unit with a double key switch and engraved with its function.

All final circuit wiring within the landlords areas shall be concealed within the building fabric and provided via 6242B LSOH twin and earth type cabling. Where a surface installation is required wiring shall be provided via 6491B LSOH single core cables in galvanised trunking and conduit.

7.4 SWITCH PLATES AND ELECTRICAL ACCESSORIES

All switch plates & electrical accessories within the residential building will be in accordance with the employers requirements.

All switch plates & electrical accessories in the Community Centre will be charcoal plastic finish or other colour contrasting to comply with part M and DDA.

7.5 LIGHTING

Luminaires

Luminaires throughout the residential block will be LED source and all in accordance with the Employers Requirements.

Recessed downlights will be provided to the refurbished WC's and breakout space.

Linear suspended luminaires and modular fittings shall be provided in the Community Centre

External areas and walkways around the building will be provided with IP rated wall lights.

Controls

Residential and landlords lighting controls will all be as per the employers requirements.

External building mounted lighting will be controlled via time clock and photocell with manual override.

Community centre main hall will be switched in banks of light fittings, toilets and kitchen will be controlled with PIR detectors with a run on timer.

7.6 EMERGENCY LIGHTING

An emergency lighting system will be provided as dictated by the employers requirements.

Directional escape signage will be provided as self-contained maintained luminaires with pictograms indicating the emergency exits and exit routes.

7.7 FIRE ALARM

A fire alarm system will be provided to the residential and landlords areas as dictated by the employers requirements.

A L3 fire protection system is proposed for the community building and is to be discussed further with the client alongside the proposed fire strategy.

7.8 CCTV

The employers requirements do not call for a CCTV system therefore it is not proposed.

7.9 DATA NETWORK

Data outlets will be provided as dictated by the employers requirements.

A data system is not proposed for the Community Centre.

7.10 ACCESS CONTROL

An access control system will be provided as dictated by the employers requirements.

Access control for the Community Centre is to be discussed further with the client.

7.11 SECURITY SYSTEM

The employers requirements do not call for a security system for the residential block therefore it is not proposed.

A security system for the Community Centre is to be discussed further with the client.

7.12 TV SYSTEM

An IRS TV system will be provided to the residential block as dictated by the employers requirements.

A TV system is not proposed for the Community Centre.

7.13 LIGHTNING PROTECTION

A lightning protection risk assessment will be undertaken to ascertain if a lightning protection system is required for the development as a whole.

7.14 PV SYSTEM

A complete photovoltaic array installation will be provided as stated in item 4.5 of this document. The system will include all necessary inverters, controllers, framework, ballasts and fixings as required.

APPENDIX A - AS DESIGNED SAP CALCULATION OUTPUT DOCUMENT

SAP Design Stage Assumptions V2

HWM

26/08/2020

By: C.D

Reviewed: A.W.

Notes

Text in **RED** to be completed by the project team. All information needs to be completed to allow the final Building Regulations SAP models to be run.
 Text in red will be used in lieu of design information where data is not provided to SCS. Text in red based on previous project experience but should be checked by project team to verify its applicability to this project.

Build Elements	Proposed Input	Evidence References (for SCS use)
Walls with heat loss		
External Wall (W/m ² .K)	0.23	SCS Assumption
External Wall -Build-Up	Cavity Wall: 13mm wet plaster, medium dense block, partially filled cavity (75mm PIR), 50mm cavity, facing brickwork	SCS Assumption
Corridor Walls to Apartments (e.g. unheated corridors) (W/m ² .K)	0.25	As per E-WM-21 party wall construction - SCS assumption
Corridor Walls to Apartments - Build-Up	Cavity Wall: 13mm wet plaster, medium dense block, filled cavity ($\lambda = 0.036$)	
Stairwell Walls to Apartments (e.g. unheated stairwells) (W/m ² .K)	0.25	As per E-WM-21 party wall construction - SCS assumption
Stairwell Walls to Apartments - Build-Up	Cavity Wall: 13mm wet plaster, medium dense block, filled cavity ($\lambda = 0.036$)	
Walls to Non-Domestic UNHEATED Areas (e.g. bin stores) (W/m ² .K)	0.25	As per E-WM-21 party wall construction - SCS assumption
Walls to Non-Domestic UNHEATED Areas - Build-Up	Cavity Wall: 13mm wet plaster, medium dense block, filled cavity ($\lambda = 0.036$)	
Party Walls - Between Apartments		
Party Wall Type and Build-Up	Fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements.	As per Employers requirements document (page 85)
Party Wall Type and Build-Up	e.g. Plasterboard on dabs, dense block - E-WM-21	As per drawings
Party Wall (W/m ² .K)	Based on above so SAP model assumes zero heat loss between two equally heated domestic spaces.	SAP default
Internal Walls within Apartments		
Internal Walls within Apartments - Build-Up	Plasterboard on traditional solid blockwork	As per Employers requirements document (Page 91)

Build Elements	Proposed Input	Evidence References (for SCS use)
Roofs		
Flat Roof (W/m ² .K)	e.g. 0.15	SCS Assumption as no information within Employers requirements
Flat Roof - Build-Up	e.g. Flat roof, concrete plank, plasterboard, insulated at ceiling level	SCS Assumption
Balcony Terrace Roof (W/m ² .K)	e.g. 0.15	SCS Assumption
Balcony / Terrace Roof - Build-Up	e.g. Flat roof, concrete plank, plasterboard, insulated at ceiling level	SCS Assumption
Floors		
Ground Floor (W/m ² .K)	0.13-0.14	SCS Assumption/ rough calculation from build ups - to be targeted
Ground Floor - Build-Up	Slab on ground solid floor. 75mm Ecotherm, 75mm EPS.	As per drawings
Floor above UNHEATED Communal Areas (e.g. corridors) (W/m ² .K)	0.25	SCS Assumption
Floor above UNHEATED Communal Areas - Build-Up	Precast concrete plank floor (screed laid on isorubber), carpeted. - E-FC-14 with insulation below to achieve U-value	As per Drawings
Party Floors		
Party Floors - Build-Up	Precast concrete plank floor (screed laid on isorubber), carpeted. - E-FC-14	As per Employers requirements document (page 95) and drawings
Windows, Doors and Rooflights		
Window, whole pane (W/m ² .K)	0.8	As per Employers requirements document (page 87)
Window - Build-Up	e.g. Argon filled, triple glazed, air gap 16mm, low E coating on both sides	SCS Assumption based on information provided in drawings and Employers Requirements
Window - Frame Factor	0.39	As per Employers requirements document (page 87)
Window - Thermal Transmission	0.7	SAP Default based on BFRC Data
Window - Material	PVC	

Build Elements	Proposed Input	Evidence References (for SCS use)
Doors		
Glass Door, whole pane (W/m ² .K)	e.g. As per window	As per Employers Requirements
Glass Door - Build-Up	e.g. As per window	
Glass Door - Frame Factor	e.g. As per window	
Glass Door - Thermal Transmission	e.g. As per window	
Glass Door - Material	e.g. As per window	
Unit Corridor Door (W/m ² .K)	e.g. 1.0	SCS Assumption (taking into account shelter factor for elements to a corridor/stairwell)
Unit Corridor Door - Frame Factor	e.g. 0.7 (default)	SAP Default
Unit Corridor Door - Glass Thermal	e.g. zero (if door is solid)	N/A
Unit Corridor Door - Material	Solid PVC door	
Other Fabric Elements		
Thermal Bridging	ACDs where applicable	SCS Assumption/ required for SAP compliance.
Thermal Bridging - External Ψ Values Accredited values	Accredited E2 Other lintels (including other steel lintels) Ψ=0.30 W/m.K E3 Sill Ψ=0.04 W/m.K E4 Jamb Ψ=0.05 W/m.K E5 Ground floor Ψ=0.16 W/m.K* E7 Party floor between dwellings (Flats) Ψ=0.07 W/m.K* E16 Corner (normal) Ψ=0.09 W/m.K E17 Corner (inverted) Ψ= -0.09 W/m.K E18 Party Wall between dwelling Ψ=0.06 W/m.K P4 Roof (insulation at ceiling level) Ψ =0.12 W/m.K Default E20 Exposed floor Ψ=0.32 W/m.K* E21 Exposed floor (inverted) Ψ=0.32 W/m.K* E14 Flat roof Ψ=0.08 W/m.K* E15 Flat roof with parapet Ψ=0.56 W/m.K E23 Balcony, penetrates insulation Ψ=1.00 W/m.K (*0.5 to each apartment) E24 Eaves (insulation at ceiling level, inverted) Ψ=0.24 W/m.K* P1 Ground Floor Ψ =0.16 W/m.K P3 Intermediate floor between dwellings Ψ =0.00 W/m.K	* = where applicable, shelter factors have been added to these values in line with BRE SAP Conventions v8.1 Accredited junctions have only been applied at homogenous junctions - i.e. where more than one construction type is involved default values have been used. <i>(Balcony junctions have been assumed to penetrate the external wall insulation (E23) - if this is not the case, and at As Built stage details will be provided showing the detail matches the requirements of an E9 Balcony junction (external wall insulation continuous), this would result in a SAP performance benefit due to the lower Psi value associated with this junction.)</i>
Air Pressure Target@50Pa (m ³ /hr/m ₂)	3	As per email 18/08/2020
Thermal Mass	Indicative Value - High - based on Build-Ups noted above	as noted

Build Elements	Proposed Input	Evidence References (for SCS use)
Building Services		
Water Fittings	e.g. Water fittings to current Building Regulations (i.e. less than 125 litres per day)	SAP default requirement
Lighting	e.g. 100% Low Energy 12 no. fittings per unit	SAP default - number of fittings SCS assumption
Primary Heating Type	Gas Combi Boiler: Worcester Bosch Greenstar 1 Bed: 25i ErP 2 Bed: 30i ErP	SCS Assumption
Primary Heating Type Efficiency	e.g. 88-89%	
Primary Heating Controls	TRVs, programmer and thermostat	As per Employers requirements document (page 110)
Primary Heating Fuel	Natural gas	As per Employers requirements document
Electricity Tariff	Standard	SAP Default
Hot Water Heating	From main heating system, no cylinders within dwellings	
Ventilation	balanced, heat recovery	As per Employers requirements document (page 102)
Mech Vent from Approved Installation Scheme?	yes	
Mech Vent Equipment Details	e.g. Nuaire MRXBOX95 (wall mounted)	SCS Assumption
Number of Local Extract Fans	One cooker hood, one in each bathroom	
Ducting type	e.g. Rigid, insulated	SCS Assumption
Solar PV	13.58 kWp (Based on an assumption of 850 kWh/kWp) - this is the minimum value required to achieve the 35% reduction.	Calculated from results
Other Renewable Technology	None	
Building Measurements		
Drawings Data	190502_Norcot_FurtherRevisedPlanning.dwg	
Build-Up between floors	465mm	
Block Compliance		
Block Performance	Averaged performance across all apartments when formal submission of all units made to Building Control	Part L1A Building Regulations 2013 (2016)

Build Elements	Proposed Input	Evidence References (for SCS use)
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General Notes

Where unknown, overshadowing assumed to be average or unknown

Latitude assumed to be 55 degrees

Only use U-values that are not default where both the U-value and Km values are provided. These must either be provided to us either via calculations by a suitably qualified and accredited person\organisation or provided in an as built architectural / building specification document. Suitable qualification\accreditation is through membership of a recognised U-value calculation competency scheme (BBA/TIMSA [UK]), OCDEA membership (England & Wales, Northern Ireland) or any other scheme formally agreed between Accreditation Schemes/Approved Organisations and Government.

Signed by:	Signature:
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Block Compliance WorkSheet: Norcot Community Centre

User Details

Assessor Name:

Software Name: Stroma FSAP

Stroma Number:

Software Version:

Version: 1.0.4.26

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Plot 01	14.84	21.92	52.5	56.4	50.35
Plot 02	12.57	19.33	50.5	53.2	71
Plot 03	13	19.99	46.4	49.4	51.1
Plot 04	13	19.99	46.4	49.4	51.1
Plot 05	15.39	22.33	56.9	61.9	50.39
Plot 06	13.28	19.54	52.4	54.6	70
Plot 07	12.15	18.72	48.5	49	73.93
Plot 08	9.24	16.82	37.4	41.7	74.27
Plot 09	10.59	17.68	36.2	37.6	51.1
Plot 10	10.72	17.72	36.7	37.7	51.1
Plot 11	9.71	17.36	39	43.3	71.11
Plot 12	10.24	17.24	41.2	43.4	71.96
Plot 13	14.74	21.3	59.3	62.5	73.93
Plot 14	13.93	20.24	57	59.4	74.27
Plot 15	14.6	21.29	53.3	56.1	51.1
Plot 16	14.6	21.29	53.3	56.1	51.1
Plot 17	13.56	20.06	55.3	57.1	71.11
Plot 18	12.89	19.63	52.5	55.7	71.96

Calculation Summary

Total Floor Area	1130.88
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Average TER	19.47
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Block Compliance WorkSheet: Norcot Community CentreCont.

Average DER	12.63
Average DFEE	48.73
Average TFEE	51.47
Compliance	Pass
% Improvement DER TER	35.13
% Improvement DFEE TFEE	5.32

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APPENDIX B - AS DESIGNED BRUKL OUTPUT DOCUMENT

Project name

Norcot Community Centre**As designed**

Date: Wed Aug 26 09:09:03 2020

Administrative information**Building Details**

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Design Database

Interface to calculation engine version: v26.06.00.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.2
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.26	0.35	001 Partition 1
Floor	0.25	0.13	0.13	001 Exposed Floor 1
Roof	0.25	0.15	0.15	001 Exposed Roof 1
Windows***, roof windows, and rooflights	2.2	0.8	0.8	001 Window 1 (1)
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Underfloor Heating + Natural Ventilation - Hall, Circulation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for 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.					

2- Underfloor Heating + Mechanical Ventilation - WC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for 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.					

1- Default DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.94	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
003	0.3	-	-	-	-	-	-	-	-	-	-	N/A
004	0.3	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
001	-	154	-	478

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
005		-	480	-	10
002		235	-	-	11
003		243	-	-	20
004		-	538	-	8

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?
001	NO (-19.5%)	NO
003	N/A	N/A

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?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	97.6	97.6
External area [m ²]	316.7	316.7
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	76.45	116.76
Average U-value [W/m ² K]	0.24	0.37
Alpha value* [%]	32.47	18.26

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	34.84	56.6
Cooling	0	0
Auxiliary	2.39	1.62
Lighting	14.96	14.44
Hot water	4.02	4.38
Equipment*	6.19	6.19
TOTAL**	56.21	77.03

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

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	7.6	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	288.39	263.2
Primary energy* [kWh/m ²]	99.33	122.45
Total emissions [kg/m ²]	13.2	21.3

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	112.8	172.7	37.4	0	2	0.84	0	0.94	0
Notional	185.7	72.7	63	0	0.9	0.82	0	----	----
[ST] No Heating or Cooling									
Actual	559	0	0	0	0	0	0	0	0
Notional	564.6	0.8	0	0	0	0	0	----	----
[ST] No Heating or Cooling									
Actual	153.2	12.6	0	0	7.5	0	0	0	0
Notional	108.9	38.6	0	0	10	0	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	184.7	4.7	61.2	0	7.4	0.84	0	0.94	0
Notional	147.7	14.1	50.1	0	8	0.82	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.23	001 Wall 1
Floor	0.2	0.13	001 Exposed Floor 1
Roof	0.15	0.15	001 Exposed Roof 1
Windows, roof windows, and rooflights	1.5	0.8	001 Window 1 (1)
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

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