

# **Design Requirements - Domestic Properties**

## **1.0 Introduction**

### **1.1 Role & purpose of this document**

The purpose of this supplementary document is to set out The Highland Council's design requirements for residential properties in the Highland region. The council's intention is that all residential properties are sustainable, energy efficient, low carbon and of a high standard of design, minimising management and maintenance problems in the future.

The general mechanical and electrical design requirements defined herein form the basis of the design for the mechanical and electrical components and systems of the project.

However, The Highland Council does not intend that this document restricts the consultant's scope to find creative solutions for each project. Nonetheless, consultants should inform the council's Energy & Sustainability Team when requirements within this document cannot be met or if an alternative solution is believed to be more beneficial to the project.

Furthermore, the council's Energy & Sustainability Team must be informed of any variations between the actual project design and the design requirements set out in this document. All variations to these design requirements must be agreed with the Energy & Sustainability Team in advance of the tender submission.

Finally, nothing within this document should lessen the professional responsibility of the consultant and they should inform the council's Energy & Sustainability Team as early as possible if the requirements of the brief conflict with the financial constraints of the project, any statutory requirements, good practice or their professional judgement.

### **1.2 Related documents**

This design requirements document should be used along with the other regulation publications governing M&E design –

- British Standards
- Building (Scotland) Regulations
- CIBSE Guides
- BREEAM
- IEE Wiring Regulations (BS 7671)

The requirements set out in this document may require systems to be designed over and above these guides, regulations and standards.

The design and specification of all Highland Council tender submissions shall remain in full accordance with all applicable guides, regulations and standards.

## **2.0 General Principles**

### **2.1 Who do these standards apply to?**

All design consultants employed by The Highland Council must design the M&E services using these design requirements along with all other relevant regulation publications.

## 2.2 What do these standards apply to?

These requirements apply to all residential domestic developments, including new dwellings, conversions and refurbishment projects.

## 3.0 Mechanical Design Requirements

Every Highland Council domestic property must have an energy efficient, cost effective full central heating and hot water system which allows the tenant to adequately heat the property at a reasonable cost using as little energy as possible.

A full central heating system comprises a heat source in every room including the bathroom, toilet and hall, designed to current standards and regulations while also providing an adequate supply of hot water to the property.

All project designs presented for tender to the council should ensure a comfortable yet functional environment for prospective tenants.

### 3.1 Internal Design Temperatures

The heating system will be designed such that the temperatures in each room should be as detailed below, when the external temperature is as stated in the External Design Conditions document (dependant on location) and where two air changes per property are assumed:

Livingroom / Diningroom	21°C
Kitchen	18°C
Bedrooms	18°C
Circulation Space	18°C
Bathroom / Toilet	21°C

Note: Properties designed for the elderly and disabled should be designed to be 21°C throughout.

However, the heating system should be capable of providing 3°C higher temperatures in each room than the standards suggest, as comfort levels differ from one person to the other.

### 3.2 Preparation

Every domestic property must be individually surveyed in order to ascertain the internal furniture layout; it cannot be assumed that all properties of the same type have the same furniture layout as this will lead to installation issues when the project goes on site.

All properties must also have a SAP calculation carried out before beginning the M&E Design.

### 3.3 Installation

All pipework should be installed within partition walls, floors or ceilings. Pipework installation in external walls should be avoided unless absolutely necessary; should this be necessary then this pipework should be insulated with 25mm domestic pipe tube insulation.

Any pipework which is unable to be concealed and instead runs on the surface of any walls, ceilings or floors must be neatly boxed in.

All heating pipework runs must rise to radiators ensuring that the heating system can be fully vented.

A drain point must be installed at the lowest point of both the heating and domestic systems and be easily accessible for draining the systems, when and if required.

#### **3.4 Heating/Domestic Pipe & fittings**

All pipework and fittings for water and gas in sanitary and heating applications will be installed in copper tube and fittings.

#### **3.5 Drainage Pipe & fittings**

The above ground soil drainage system will be installed in grey PVC-U above ground soil pipe and fittings while the waste systems will be installed in white polypropylene pipe and fittings.

#### **3.6 Pipe supports & clips**

All pipework must be installed and supported using appropriate pipe clips, brackets or band; spacing of pipe clips will be as advised by the pipe manufacturer. Pipework must not be left unsupported even where not visible.

#### **3.7 Valves**

When installing a system with a heat source which provides both heating and hot water the heating circuit will have one 2-port control valve along with another 2-port control valve on the hot water circuit, allowing total control over which circuit receives heat from the boiler. In addition, an automatic bypass valve will be installed to allow water to flow from flow to return when the pressure generated by the pump is high due to both 2-port valves being closed.

When installing a wet radiator system bi-directional thermostatic radiator valves will be fitted to all radiators apart from the radiator which is situated in the same area as the room thermostat.

All items of plant and sanitaryware (i.e. pumps, radiators, taps etc.) must be valved and able to be isolated in order that they can be easily removed and replaced if need be.

#### **3.8 Insulation**

All pipework within internal walls must be insulated with 19mm domestic pipe tube insulation. Pipework installed within external walls will be insulated with 25mm domestic pipe tube insulation.

All insulation must be installed neatly and without gaps.

#### **3.9 System Additives**

All heating systems will include the installation of a combined inhibitor & anti-freeze product in order to prevent corrosion of pipework and freezing of the water within the system during extreme cold weather.

#### **3.10 Heat Source**

Of the various heat sources available to The Highland Council's domestic properties there is a hierarchy of fuels to be used; gas, renewables, electric fan assisted storage heaters and Oil. This is the order in which the fuels should be considered - with a Fuel Options and Running Costs Appraisal carried out for each property.

Particular important should be given to the long term performance of each system along with the ease and cost effectiveness of future maintenance.

Additionally, regardless of the heat source chosen consideration must be given to it's location within the property. This is where the individual property surveys become invaluable as they will highlight the position of furnishings in each home, clearly showing suitable locations. Kitchen layouts can be altered and cupboards constructed to suit the chosen system; in the case of a gas or oil boiler an external wall is the preferred position for installation but may not be possible without internal alterations.

Finally, all properties having new heating installed which currently have open coal fires will have the coal fire removed and blocked up and the chimney, where practical, removed to below roof level and roofed over. An electric focal point fire will be provided to replace the open coal fire.

- 3.10.1 Gas Boiler - Either a condensing gas system boiler or a combination condensing gas boiler should be installed in domestic properties; the boiler efficiency must be at least 90%.

A combination boiler must only be used when a property has one bath/shower and no more than two bedrooms. Otherwise a condensing system boiler with hot water cylinder must be used.

The boiler must have an interlock to prevent firing when no demand for hot water or heating exists. The wiring circuit to and within the boiler and to the pump must ensure that both are switched off when there is no demand.

When using a gas boiler the heating system will be a sealed, forced heating system with reverse return and will include motorised 2-port valves (system boiler), room thermostat and programmer along with thermostatic radiator valves (when using radiators as the heat source).

A balanced flue is the preferred flue option for installation with all gas boilers; however, a vertical flue should be installed where it is not possible to use a balanced flue.

- 3.10.2 Oil Boiler – Either a condensing oil system boiler or a combination condensing oil boiler can be installed in domestic properties; the boiler efficiency must be 90% or greater.

A combination boiler must only be used when a property has one bath/shower and no more than two bedrooms. Otherwise a condensing system boiler with hot water cylinder must be used.

Oil boilers must also have an interlock to prevent firing when no demand for hot water or heating exists. The wiring circuit to and within the boiler and to the pump must ensure that both are switched off when there is no demand.

When using an oil boiler the heating system will be a sealed, forced heating system with reverse return and will include motorised 2-port valves (system boiler option), room thermostat and programmer along with thermostatic radiator valves (when using radiators as the heat source).

A balanced flue is the preferred flue option for installation with all oil boilers; however, a vertical flue should be installed where it is not possible to use a balanced flue.

- 3.10.3 Air Source Heat Pump – a balanced whole house heat recovery ventilation system with an integral Air to water heat recovery heat pump for space heating and domestic hot water production. Additional efficiency is achieved by recovering heat from the properties exhaust air, as part of a mechanical ventilation system and utilising the heat in this in the production of hot water through the heat pump.

A minimum COP of 2 must be achievable by the air source heat pump.

Before considering the installation of an ASHP the building fabric must be taken into account; the property must be adequately insulated with good quality double glazed windows and doors. The better the building fabric of the property the more efficiently the ASHP will operate and the lower the operating costs will be.

Additionally, the tenant's use of the system must also be considered as depending on the occupant's lifestyle the ASHP may not be the most suitable option available i.e. a tenant who requires a warm house 24/7 will not find this form of heating cost effective, especially during winter months.

A hot water cylinder would be used with all ASHP's allowing a hot water store within the property; the hot water will be heated using the heat pump and an immersion heater.

All air to water heat pump manufacturers and installers must be MCS accredited.

- 3.10.4 Wood Pellet Stove - A woodpecker wood pellet boiler with 94% efficiency (or equal and approved) is the ideal boiler for installation into Highland Council properties. The boiler has LCD controls, pneumatic air cleaning and de-ashing features incorporated; ensuring easy installation and use.

A tank in tank thermal store cylinder with solar coil will be used with all wood pellet stoves allowing storage of hot water for both the heating system and domestic hot water, with future provision for a solar hot water system.

All wood pellet stove manufacturers and installers must be MCS accredited.

- 3.10.5 Wood Log Boilers - A wood log boiler with an efficiency of at least 92% would be considered for installation within a domestic property due to the possibility of having as short a payback as 3 years.

A hot water cylinder would be used with all wood log boilers allowing a hot water store within the property, heated by the wood log boiler.

All wood log boiler manufacturers and installers must be MCS accredited.

- 3.10.6 Electric Storage - Fan assisted electric storage heaters such as Dimplex FXLi Storage Heaters or Elnur Fan Assisted Storage Heaters (or equal and approved) may be installed within Highland Council domestic properties alongside a hot water cylinder which will provide domestic hot water, heated by an electric immersion.

Fan assisted storage heaters are sophisticated at using off peak electricity. Instead of automatically releasing the heat by convection the next day, a fan assisted storage heater incorporates a silent fan, which discharges air through the vent at the base of the heater only when required.

The heat is stored inside a highly thermal insulated unit, more than double the insulation thickness of standard storage heaters.

### 3.11 Radiators

Compact style steel panel radiators with factory fitted top grilles and end panels are to be installed within The Highland Council's domestic properties.

All radiators will be fitted with 15mm thermostatic and lock shield radiator valves (of a type which are easy to grasp). Radiator brackets will be mounted correctly, with secure fixings into the wall, ensuring that the radiator, when hung on the brackets, is completely secure.

If required, a wooden board may be installed behind the radiator to ensure secure fixing to wall; the board size must be kept to a minimum, ensuring that it only covers the area required to fix the brackets and is to be painted white.

Silver heat reflective foil should also be installed behind radiators to reflect the heat from the radiator back into the room, maximising heat gain.

Radiators should be positioned where they do not hamper wheelchairs turning into a doorway or reduce the clear width of a passage to less than 900mm.

Radiators should be situated so that they do not create unnecessary unusable wall space. In particular careful consideration should be given to the location of the heating appliance in the

bathroom with due regard to utilisation of wall space and safety and in kitchens, where useful wall space in general is at a premium.

### **3.12 Underfloor**

LTHW Underfloor heating will be an option when designing heating systems within new properties; this form of heating is considered to be sustainable due to its use of lower water circuit temperatures which are ideally suited to renewable technologies.

When installing underfloor heating the system must be a poured floor system, be of closed circuit design and contain a mix of water and anti-freeze.

Controls should consist of zone thermostats along with thermostatically controlled manifold assemblies.

Underfloor pipes rising from within the floor screed up to the manifold must be boxed in with an access panel and the pipes individually insulated.

### **3.13 Hot Water Cylinders**

3.13.1 Wet System - A solar unvented stainless steel twin coil indirect hot water cylinder\* will be fitted within all properties regardless of whether solar thermal panels are also being installed at the time of the heating/hot water installation.

The only exception to this will be when installing a wood pellet stove or wood log boiler; in this instance a stainless steel multi-energy (with provision for the inclusion of a solar hot water system) tank -in-tank cylinder where an inner stainless steel hot water cylinder is heated by primary water circulating through a surrounding outer tank connected to the heat source in the usual way. A larger heat transfer surface means that Tank-in-Tank units recover much faster than any other kind of hot water storage device – and keeps the cycling, of the heat source, to a minimum.

3.13.2 Electric System – A solar unvented stainless steel twin coil indirect hot water cylinder \* will be fitted within all properties with ASHP's and other forms of electric heating which does not provide stored hot water.

This is to ensure that should the heating system be changed to a system which can provide domestic hot water, at a later date; the cylinder will be able to accommodate this without being replaced.

\*All hot water cylinders must be fully insulated.

### **3.14 Thermostatic Mixing Valves**

Baths and showers will be fitted with thermostatic mixing valves to prevent scalding.

### **3.15 Controls**

Along with the necessary 2-port valves, thermostatic radiator valves etc (depending on the system being installed) the following controls are required; the heating system will include a Honeywell T6360 (or equal and approved) room thermostat with summer/winter switch along with a Honeywell ST9400S (or equal and approved) 7day 24hr 2-channel programmer with service reminder, shut-down feature and PIN code protection.

The hot water system will include a Honeywell L6190B (or equal and approved) hot water cylinder thermostat to control the temperature of the hot water. The Honeywell (or equal and approved) 7 day 24hr 2-channel programmer will also allow timed control of the hot water system.

The programmer must allow independent operation of the heating and hot water systems and also be able to switch the heating on and off at least three times a day.

The programmer must be mounted in a convenient location in the kitchen of the property.

### **3.16 Solar Hot Water**

Flat plate collector, solar hot water systems will be installed in all Highland Council domestic properties which have roofs which face up to 45 degrees each way off south (between SW and S or SE and S), as long as no other buildings or large trees overshadow it.

All properties may, at a future date, have solar hot water systems installed regardless of which direction the properties roof faces. This is why all properties will have a solar unvented stainless steel twin coil indirect hot water cylinder installed at the time of refurbishment or construction.

The closed loop solar system must contain glycol, as per panel manufacturer's instructions, to maximise heat transfer and minimise the risk of the system freezing during colder months.

Finally, the structural soundness of the properties roof must be considered before installing solar hot water systems; this must be checked prior to the design of the M&E systems to ensure feasibility.

### **3.17 Ventilation**

The kitchen, bathrooms and toilets within a domestic property must be ventilated to provide the appropriate air change rate.

Ventilation will be via a Vent Axia Lo Carbon Tempra single room heat recovery unit (or equal and approved), ensuring that the heat in the extracted air is not wasted but recovered and used to warm the incoming air.

A humidistat should be installed with the extract fan in bathroom; this prevents the tenant from forgetting to turn the fan on, in turn reducing the risk of condensation and mould growth in the bathroom.

The ventilation duct, when mounting the fan on the wall, must be angled slightly to allow condensation to run along the duct and out through the external louvre. If installing the fan on the ceiling a solid ducting system must be used and a condensation trap installed to allow any condensate created within the duct to easily be removed.

Where a condensate trap is used access must be provide for periodic cleaning.

Insulation must be fitted to all ductwork installed within unheated spaces i.e. attic space. Insulation must be fitted securely and without gaps.

External louvres must be white plastic with anti-backdraught flap for wall mounted installations and a cowl, with integrated bird guard, extension sleeve and weathering collar for ceiling mounted installations.

## **4.0 Electrical Design Requirements**

All electrical installations must be designed, installed and tested to comply with the 17<sup>th</sup> Edition I.E.E. Regulation and meet the requirements of BS7671.

### **4.1 Preparation**

Every domestic property must be individually surveyed in order to ascertain the internal furniture layout; it cannot be assumed that all properties of the same type have the same electrical layout as this will lead to installation issues when the project goes on site.

### **4.2 Supply Assessment**

The designer shall make an assessment of the new supply and liaise with the supply authority for new supplies.

Where electrical rewires are being conducted the designer shall assess the adequacy of the existing supply including earthing arrangements and make appropriate upgrades via the supply authority where required.

Where heating replacements are being conducted the designer shall assess the adequacy of the existing supply including earthing arrangements and make appropriate upgrades via the supply authority where required.

### **4.3 Incoming Electrical Supply**

A double pole isolator is required between the meter and each consumer unit. The meter tails shall be LSF insulated and sheathed type.

The contractor is to obtain & install paper seals from the supply authority on the completion of electrical works where required.

Meter cupboards are required for all service locations and existing cupboards shall be enlarged where required.

### **4.4 Distribution Equipment**

17<sup>th</sup> Edition consumer units are required which shall be specific to type of installation and all new distribution equipment requires new ply back boards.

The consumer units shall be rated to suit maximum demand, incorporate RCBOs, 20% spare capacity and IP44 metal housing. They should be safety labelled appropriately and this shall include a five year notice until next periodic inspection & test. New circuit charts shall be provided at each new or existing consumer unit.

All circuits within the consumer unit shall be divided appropriately and preferably incorporate individual RCBOs.

### **4.5 Small Power**

All fixed appliance equipment shall include a means of isolation to allow for maintenance activities. Fixed power accessories shall have neon indicators.

Quantities of socket outlets are as shown in BS7671 and the building regulations. However quantities of sockets shall be designed to negate the need for adaptors and extensions leads.

All electrical accessories installed shall be from a single manufacturer. Where alteration works is conducted to small areas then all electrical accessories within the room shall be replaced to a single manufacturer.



#### 4.6 Ventilation

Fan outlet points shall be 16amp unswitched fused connection units to BS 5733 having knock-out flex outlets at the lower edge and a correctly rated fuse for the appliance served. The cable between the FCU and the fan unit shall be through the back of the FCU box.

Fan outlet points shall be ceiling/wall mounted and located adjacent to the ceiling/wall mounted fan unit. Fan outlet points in bathrooms shall not be accessible from the bath.

#### 4.7 Lighting

The installation shall have an electric lighting system providing at least one lighting point to every circulation space, kitchen, bathroom, toilet and other space having a floor area of 2 m<sup>2</sup> or more.

All lighting points to incorporate low energy lamps where appropriate.

Product guide:

- All lamp holders shall be safety type
- Fluorescent lights to be HF battens with prismatic diffuser
- Bathroom lights to be enclosed fittings (IP55) with opal diffuser and white trim
- External lights to be enclosed fittings (IP55) with prismatic diffuser.

Lighting levels shall be designed to comply with the appropriate standards and building regulations.

#### 4.8 Lighting Controls

Lighting shall be controlled using manual switching. Where new external lighting has been installed the lights shall have an integral passive/photocell detector and manual switch.

#### 4.9 Fire Alarm

Smoke, heat and CO detectors shall be mains powered type and incorporate lithium cell 10 year rechargeable battery backup. All detectors shall be hard wired and supplies for the detectors shall be taken from the local lighting circuits using 1.5mm<sup>2</sup> LSF cable. All detectors must be interlinked.

Any new fire alarm system shall be designed as follows:

- Grade D
- Category LD2

Product Guide:

- Optical detector – Aico Ei166RC
- Heat detector – Aico Ei164RC
- Ionisation detector – Aico Ei161RC
- CO detector – Aico Ei261ENRC
- Strobe – Aico Ei169/160

#### 4.10 Cabling

Meter tails shall be a minimum of 25mm<sup>2</sup> LSF insulated and sheathed cable. General wiring shall be Multi-core LSF insulated and sheathed cable.

All final circuit cabling shall be concealed where possible. Where rewiring is being conducted in a dwelling with solid walls then either the cabling should be ragged into walls where possible or a proprietary skirting and architrave trunking system should be used.

#### 4.11 Television

A television installation if required shall be via digital antennae and be an individual service for the household. Television outlets are required and shall be push in type.

#### 4.12 Certification

Electrical certification shall be provided on the following basis:

<b>Type of Work Completed</b>	<b>Type of Form Required</b>
New Installation or change to existing installation	Electrical Installation Certificate
New installation work that does not include the provision of new circuit	Electrical Installation Certificate or Minor Electrical Installation Work Certificate
Alterations or additions	Electrical Installation Certificate
Alterations or additions that does not include the provision of a new circuit	Electrical Installation Certificate or Minor Electrical setting up Work Certificate

### 5.0 Drawings

All design drawings must contain all relevant and accurate M&E information including –

- The actual position of each heat source whether internal or external, further to individual property surveys.
- The actual position of any radiators within each property, further to individual property surveys.
- The actual position of the hot water cylinder within each property, further to individual property surveys.
- Where gas is being used: the external gas meter box and the gas supply pipe route from the external meter box to the boiler must also be clearly shown along with any access hatches or ventilation grilles required. This route will have been confirmed during the individual property surveys.
- Where oil is being used: the position of the external oil tank and the oil supply pipe route from the external tank to the boiler must also be clearly shown along with any trenches required. This route will have been confirmed during the individual property surveys.
- Where an externally located heat source is being used i.e. GSHP or ASHP details of how the flow and return pipework will enter the property should be clearly shown.

The purpose of the design drawings is to provide as much accurate information as possible so that the project can be accurately tendered and additional costs during the works are kept to a minimum. The individual property survey is the key to this.

### 6.0 Commissioning

All heating, hot water and ventilation systems must be commissioned as per manufacturer's instructions.

All commissioning certificates and other paperwork must be retained and given to The Highland Council.

Additionally, copies of manufacturers operating and maintenance instructions for all equipment and controls must be submitted to The Highland Council, along with any tools required for the operation, maintenance and cleaning of the systems.