Wood pellet fuel utilisation design guide

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FOREVER FUELS

Predictable Prices.
Stable Supply.
Controlled Carbon Emissions.

The mission of Forever Fuels is to create a national distribution network for clean sustainable wood pellet fuel.

We aim to create customer confidence by establishing a distribution network which matches or surpasses the convenience of current heating oil supply or, for those of us with long memories, the heyday of coal supply.

We hope that this confidence in reliable fuel supply will encourage specifiers and users of heat to consider the range of proven technologies available from our installation partners, and will generate a significant switch to the low-carbon, cost-effective benefits of automatic wood heating.

The objective of this guide is to highlight the key issues to address when considering wood pellet heating. We are conscious that in some cases it will be preaching to the converted, while in others we may not have delivered sufficient explanation or technical detail.
In this respect we would like to make three requests:

- Please give us your feedback on the guide, your experiences, or any other information you feel may be valuable. We intend it to be a living document, and a two-way street will establish best practice more quickly.
- If you have any questions, please contact us. We will often know the answer. If we do not, we have a network of partners with unrivalled experience, and access to huge amounts of information. The number and nature of questions will also help to shape future versions of this guide.
- Forgive us. The market is poised on the verge of exponential growth, and those interested comprise a very broad church.

Many thanks for your interest; we look forward to a fruitful dialogue in future.

Graham Hilton
Managing Director
Forever Fuels

1. About wood pellets

1.1 Pellet sources

The UK has a plentiful supply of raw materials for wood pellet manufacture. In 2005 the Biomass Task Force estimated the total UK availability of all biomass materials to be in excess of 20 million tonnes per annum.

In addition, wood wastes were estimated to be between five and six million tonnes a year. Of this, 1.4 million was recovered in 2004, leaving a further 1.5 million tonnes of high-quality wood and two to three million tonnes of low-quality waste wood for large commercial users and power generation. These figures far exceed the total estimated current UK demand of 10,000-20,000 tonnes a year, for all uses except power generation.

Specifically, pellets can be manufactured from:

- Virgin sawdust from the core of trees or from processing untreated timber
- Whole tree chippings, including bark
- Recycled wood
- Other biomass material, including straw, coppiced wood, and other recycled material.

However, unlike power generation, which can be fired by lower-quality biomass materials, most commercial and domestic scale pellet boilers have warranties that stipulate a certain standard of fuel. This means that only pellets made from virgin sawdust can be used in most commercial and domestic boilers.

Wood pellets Image courtesy Balcas Ltd

In 2003 it was calculated that the UK produced an estimated 859,000 tonnes of virgin sawdust and off-cuts a year as a by-product of the sawmilling industry, 10 per cent of which is not used by existing industry. In total, 1.3 million tonnes of sustainably produced wood from managed woodlands could be used without serious disruption to existing wood-using industries or agriculture.

Sawdust has mainly been used in the production of boards, such as MDF. But, driven by landfill taxes and recycling legislation, the board manufacturing industry is switching to cheaper recycled wood, which has led to an increase in the supply of virgin wood for pellet manufacture.

In addition, approximately 400,000 tonnes of sawdust is imported each year by the power industry in the form of 8-25mm pellets. Although this material cannot be used in domestic pellet boilers it can be used in most large commercial and industrial settings.

According to both the Biomass Task Force and the UK Biomass Strategy there is the potential to produce eight million tonnes of energy crops from one million hectares of arable land. Advances in crop technologies are continually improving the yields of energy crops, which are often closer to 10 tonnes per hectare.

1.2 Pellet production

Pellets are produced by extruding raw sawdust through a dye. The energy produced in the process causes the natural lignin in the wood to melt forming a solid shiny outer coating. Some manufacturers also add starch or other lingo-based materials.

Pellet die producing 6mm pellets

To manufacture pellets successfully, the raw sawdust has to have the correct particle size distribution, usually 3-5mm. This is achieved by passing the raw material through a hammer mill and recycling the heavier fractions. In order to meet EU specifications the sawdust also has to be dried to the correct moisture level of approximately 10 – 13 per cent, before entering the press.

The capacity of the extrusion plants, known as pellet mills, can vary from 250kg per hour to five tonnes per hour. Large manufacturers will have several machines running continuously.

After extrusion, the pellets are cooled and then stored in warehouses or silos ready for despatch either to delivery depots or the customer in covered trucks.

Wood chip at sawmills is a low-cost source of heat for drying the sawdust, and can be used to power the entire pellet production process.

As dry pellets are more efficient to transport than wet sawdust, they are normally made at source. Alternatively a central location where sawdust from a number of local production facilities can be brought together cheaply can be used.

Pellets are normally produced in sizes between six and 25 millimetres. Smaller pellets are stronger and easier to handle. In the UK 6mm pellets are generally used as boiler fuel, while the larger pellets are used in industrial and power generation applications.

1.3 Supply and distribution

Wood pellets are stored at the point of manufacture or at depots closer to the markets that they serve. Bulk deliveries of pellets from manufacturer to storage depots are typically made in standard 30 tonne trucks.

Pellet storage silos at production plant

Pellet fuel is then typically delivered to customers in trucks between 10 and 22 tonnes in size. These complete several deliveries a day, and will normally be based at a depot convenient to the market.

It is generally most cost effective for secondary distribution to be within 50 kilometres of a depot. Beyond this distance surcharges may apply.

Surcharges may also apply for tanker deliveries under a certain weight or within a restricted time frame. For this reason, the user's storage facility should be correctly sized to match the boiler's intended use.
As well as bulk deliveries to larger installations, where pellets are pneumatically blown from the tanker to the storage facility, pellets can also be delivered in bags for smaller commercial and domestic consumers.

2. Why renewable heat? Why wood pellets?

There are a number of reasons for considering renewable energy systems. On the one hand companies may choose to include it in their CSR policy and set themselves goals for carbon savings. On the other, organisations may be obliged to adopt a certain amount of on-site renewable energy content under planning regulations or government targets.

Renewable heat is recognised as one of the most low-cost methods of cutting carbon, and can often show financial savings over its fossil equivalents, with no additional inconvenience over oil or coal-fired heating systems.

Wood pellets are an easy-to-use, cost-effective and readily-available source of renewable heat. A proven technology, they have a known and predictable burn rate, and provide a reliable and constant source of heat.

2.1 Planning

2.1.1 Regulations

Wood pellet heating systems can help meet planning and design regulations, when designing new buildings or refurbishing existing ones.

Part L and Part J Building Regulations:

- Building Regulations Part L: concerns the conservation of fuel and power and covers heating systems in new and refurbished properties.

- Building Regulations Part J: concerns combustion appliances and fuel storage systems, and covers issues such as flues, hearths and fuel storage within the building.

For more information and to download the legislative document visit: www.planningportal.gov.uk.

PPS 22, PPS 11 Regional Spatial Strategy and PPS 12 Local Development Frameworks:

PPS22 sets out the government's policies for renewable energy, which planning authorities should take into account when preparing local documents for development and when taking planning decisions.

Under PPS22 the London Borough of Merton developed the first policy that specified the amount of renewable energy that must be provided on-site for new developments. The so-called Merton Rule states:

"All new non-residential developments above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10 per cent of predicted energy requirements."

The Regional Spatial Strategies (RSS), which are being developed by the regions, integrate the Merton approach in varying degrees, and are legally binding, statutory obligations.

At a more local level, the Local Development Frameworks, which councils are required to establish, are also incorporating the Merton approach. Once again these are statutory requirements which will effectively allow councils to refuse developments that do not meet the required standards.

Wood pellet-fuelled heating systems are an ideal way for developers to meet and exceed their obligations under these statutory instruments.

Full documents are available from the planning section of: www.communities.gov.uk

Greater London Authority (GLA) guidelines:
The GLA has published its own sustainable building guide. It is in the course of developing further guidelines for the use of wood pellet fuel. These include:

- A requirement to minimise the number of vehicle movements within the London area.
- Encouragement for central depots for the storage of fuel and recovery of ash.
- Guidelines on the use of low-carbon vehicles for delivery and the impact on the congestion charge.

The GLA also encourages local energy networks, including CHP and district heating alternatives, and provides financial support for GLA-funded organisations to reduce their carbon emissions.

Further information can be found at: www.london.gov.uk

Smoke control areas:
Wood pellet boilers can be used in designated smoke control areas provided that the equipment used has been classified as an exempt appliance in accordance with the Clean Air Act of 1993. High-quality pellets made from virgin sawdust also count as an authorised fuel and can be used with the appropriate equipment in smoke control areas.

To view a list of exempt appliances and a map of smoke control areas visit: www.uksmokecontrolareas.co.uk/

2.1.2 BREEAM standards

The BRE Environmental Assessment Method (BREEAM) is designed to aid the understanding and mitigation of the environmental impacts of developments. The assessment process uses a credit system to rate the performance of new and refurbished buildings across a range of factors including water use, energy and transport. The credits are then totalled to calculate a final rating of pass, good, very good or excellent.

Credits are allocated depending on the percentage improvement in carbon emissions over the target CO2 emissions rate (TER). Typically, the installation of a biomass boiler can offer CO2 savings of around 20 per cent, which results in around 10 extra credits.

A further three credits are available for the provision of on-site renewables, as follows:

- One credit for commissioning a feasibility study into the use of renewable energy and implementing the results.
- Where evidence shows that the first credit has been achieved a further credit is available for ten per cent of the total energy demand provided by on-site renewables.
- Alternatively two credits are available if 15 per cent of the total energy demand is provided by on-site renewables.

Nitrogen Oxides (NOx):
Wood pellet boilers will generally produce higher NOx emissions and therefore may earn fewer BREEAM credits than an equivalent fossil-fuelled installation. The table below shows the credits awarded for each level of NOx emissions:

NOx level (mg/Kwh)*	Credits awarded
<100	1
<70	2
<40	3

2.2 Cost

Although historically it has been unusual for renewable energy systems to be selected by end users solely on the grounds of cost, recent increases and volatility in fossil fuel prices, particularly for those off the main gas grid, have made biomass heat a viable economic proposition in more and more situations.

2.2.1 Fuel

Wood pellets are priced in pence per kilogram (p/kg) or pounds per tonne (£/tonne). Final costs depend on location and drop size, as well as the length and size of the contract.

As with all commodities, costs are subject to change, but at the time of writing the standard list prices for small bulk drops of pellets are £180/tonne compared to £450/tonne for oil. Up-to-date prices are available on request.

However, the energy content of pellets is 4,800 kWh per tonne or 17,600MJ per tonne which is around half that of heating oil for 40 per cent of the cost. Based on these figures, the typical cost of delivered energy from wood pellets is 3p/kWh and 4p/kWh for oil.

The outlook for pellet prices is that of a modest, but continuous, reduction as new UK production is brought on line, and development of heat clusters enables the infrastructure for delivery to be best used. Recent experience on the continent has indicated that new supply responds rapidly to any increases in the price of pellets. Evidence to suggest a similar situation will occur in the UK can be seen in the accelerating growth in numbers of medium to large pellet producers.

Although difficult to predict fossil fuel prices, the government is committed to increasing their price relative to clean alternatives. Many expect fossil fuel prices to rise as supply becomes increasingly constrained and demand remains strong, aided by the growth in the emerging Chinese and Indian economies. The International Energy Authority has recently announced that it expects an 'oil crunch' in five years' time.

2.2.2 Taxation and benefits

Unlike fossil fuels, wood pellets are not subject to the Climate Change Levy or the Fossil Fuel Tax. At the time of writing, the only taxation on the purchase cost of wood pellets is Value Added Tax at 17.5 per cent for commercial use, and five per cent for domestic consumers. Exemption from VAT is available for certain users. Suppliers may be prepared to refund higher rate VAT in these cases, but it is worth confirming that they will do so before purchasing fuel.

* *At 0% excess O_2*

2.2.3 Boilers and equipment

Grants and support:
Grants on the capital cost of renewable projects are available through regional development initiatives and national programmes.

Bio-energy Capital Grants Scheme:
This scheme is run by Defra and is currently in its third phase.

Round 1 of this scheme allocated funds to developers and to certain boiler suppliers and installers. Typically 25 per cent of the capital cost of wood pellet boilers was made available through the boiler suppliers. Some funds under this scheme are still unspent, and may be available for certain types of boiler.

Round 2 of the scheme was competitive, with suppliers bidding for up to 40 per cent of the cost of an installed boiler, less the cost of an equivalent fossil-fuelled unit. The award to suppliers was announced in late September 2006.

Round 3 of the scheme was launched in December 2006 with a 10 week application window that closed in March 2007. Defra intends to run further rounds with details similar to round 3.

Low Carbon Buildings Programme:
Phase 1 of the scheme replaces the Clear Skies and solar PV grant programmes. Launched in April 2006 and managed by the Energy Savings Trust (EST), the scheme will run for three years. This first phase is separated into two funding streams aimed at promoting micro-generation technologies. Stream 1 is for households and stream 2 is for medium and large projects put forward by public sector, not-for-profit communities and commercial organisations.

Phase 2 of the scheme is designed to reduce the long-term cost of renewable equipment through large-scale government procurement initiatives of many small pieces of equipment. The process for allocating the £50m budget is managed by the Building Research Establishment (BRE). Only public sector and not-for-profit organisations are eligible. Grants for heating systems made under the Phase 2 programme are limited to those that are less than 45kW. The programme has an allocation of £4.3 million for biomass systems.

For this phase of funding framework suppliers have been appointed to oversee the supply and installation of a range of microgeneration technologies. Each supplier will provide one or more technologies through which the grant funding is made available. A full list of framework suppliers is available on the websites below.

For further details and up to date information visit:
Phase 1:www.lowcarbonbuildings.org.uk
Phase 2: www.lowcarbonbuildingsphase2.org.uk

Wood Energy Business Scheme:
This scheme is supported by the EU, the Welsh Assembly, the Welsh Development Agency and the Forestry Commission. It provides grants of up to 50 per cent of the cost of wood projects. The scheme is limited to private sector organisations in Wales.

Renewable Heat Mechanism:
Under the terms of the Climate Change and Sustainable Energy Act 2006 the government has a duty to promote renewable heat.

The heat market is a fragmented one: the vast majority of heat is generated on-site and a variety of fuels and equipment are used. This means an obligation similar to those applied to the electricity and transport markets would prove less effective.

Instead, a support mechanism could be set up to reward the generation of renewable heat while still promoting energy conservation. The government is currently being lobbied intensely to put such a mechanism in place.

Enhanced Capital Allowances (ECAs):
All energy-saving investments qualify for Enhanced Capital Allowances (ECAs). These allow users to write off 100 per cent of the capital cost in the first year. To qualify for ECAs, the heating solution that has been invested in must be operated by the owner. If the equipment is leased from the supplier, the contract must be structured to include maintenance and operational support in order to qualify for the allowance.

CERT – Carbon Emissions Reduction Targets (formerly Energy Efficiency commitment, EEC):
The CERT will replace the Energy Efficiency Commitment in 2008. Under the terms of the EEC, electricity and gas suppliers are required to achieve targets in the promotion of domestic energy efficiency. From 2008 to 2011 the CERT will allow utilities to use renewable energy as part of their obligation to reduce carbon.

In May 2007, the government published its public consultation on CERT which proposes doubling the targets. This would be equal to an annual saving of about 1.1 million tonnes of carbon (MtC) by the end of the programme. By the end of the period, CERT will have cost an estimated £3.2bn.

It is expected that biomass systems could play a major part in meeting the CERT from renewable energy.

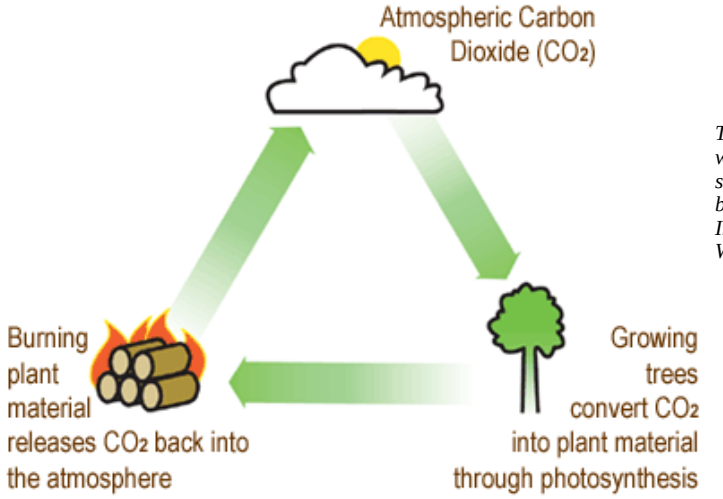
Heat manifesto:
In March 2007, a manifesto and strategy for sustainable heat were launched by a coalition of organisations spearheaded by the environmental charity, the Green Alliance. The publications highlight the importance of heat and the lack of government strategy for producing heat sustainably.

More information is available at: www.green-alliance.org.uk

2.3 Sustainability

Burning wood pellets that have been sourced through sustainable forestry is considered to be carbon neutral. As a tree grows it absorbs carbon dioxide (CO_2) from the atmosphere. The same level of CO_2 is subsequently returned to the atmosphere when the processed wood is burnt.

A small amount of fossil fuel energy is usually required throughout the wood pellet life-cycle. The total amount used in planting, harvesting, production and distribution varies between suppliers, but it is generally accepted to be less than 5 per cent of the total energy delivered to the end user.



The carbon cycle when burning sustainably sourced biomass
Image courtesy of Wood Fuel Wales

To a large extent, this energy is compensated for by the high density of wood pellets - typically 650kg/m^3 - and their high calorific value of around 4.8Kwh/kg. This reduces the number of bulk deliveries required and the amount of subsequent handling needed.

3. Project design

Contrary to some widely-held beliefs, wood boilers can cycle almost as quickly as equivalent models fired by gas and oil, and quicker than coal. However boilers should be sized appropriately to maximise the return on investments made in capital equipment.

With smaller models of boiler, accumulators or buffer tanks allow them to work on a more even heat load, and cope with peak demands which exceed the boilers' theoretical capacity.

3.1 Pellet boiler installation

3.1.1 General arrangement

Quality pellets need simple storage systems, as shown below.

Boilers should be installed close to the user's main storage facility. An auger, or pneumatic blowing mechanism, is usually used to convey pellets to a buffer storage bin connected to the boiler.

The design of good quality pellets means that they flow easily from storage to boiler, without clumping or sticking. They do not, therefore, require an additional mechanical collection system other than the auger. However, should the storage be used for other forms of fuel, various forms of collector are available.

Some boilers are equipped with automatic de-ashing systems as an option, which takes one maintenance issue out of the operator's hands and improves both convenience and health and safety.

Flues:
The typical flue should meet the requirements of Part J of the Building Regulations, with a double wall, insulated stainless steel design with draught, and blow-back flap.

It is possible to use existing flues, although they may need to be relined.

Heat controls:
Modern wood fuel boilers are fitted with microprocessor-controlled heating systems which can stand alone or be integrated with existing Building Energy Management Systems (BEMS) or domestic thermostats.

3.1.2 Typical layouts

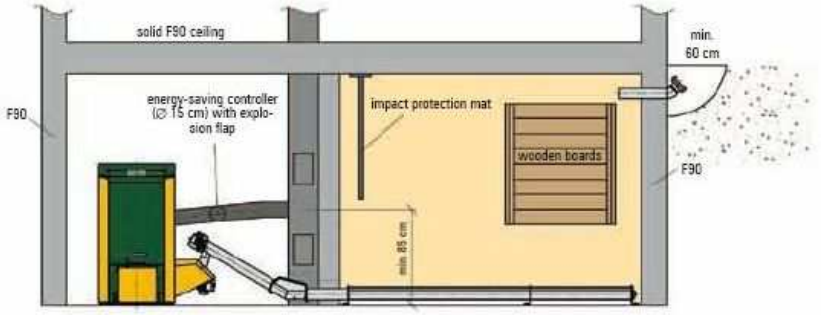
A typical layout for a small boiler with adjacent storage is shown right and below. Alternatives include storage above or below the level of the boiler, with delivery by screw conveyor or vacuum.

To maximise the storage capacity the connectors should be placed at high level with at least 200mm between the upper pipe edge and the ceiling. Connectors should be placed along the short side of the store to minimise degradation as the pellets enter the store.

Pellet storage with screw conveyor to boiler
Image courtesy of KWB/Econergy Ltd

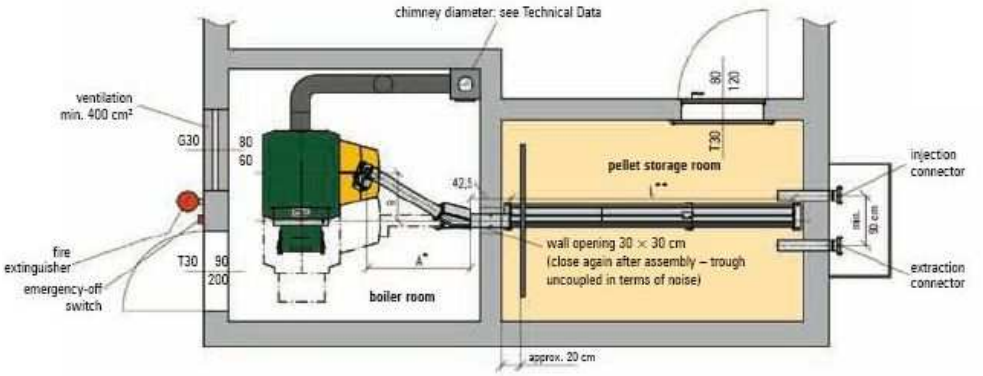
Front view

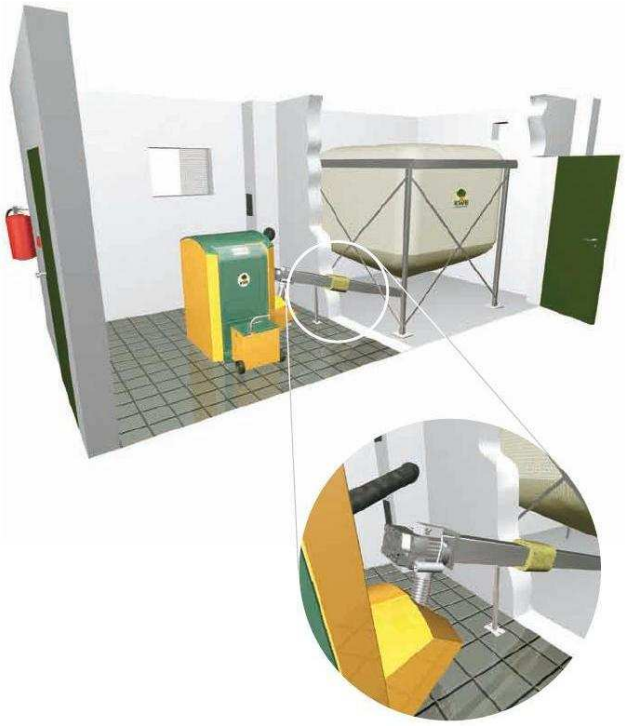
Fuel supply right



Plans showing boiler and store with screw conveyor
Image courtesy of KWB/Econergy Ltd

Ground plan





Boiler with bag silo and screw conveyor
Image courtesy of KWB/Econergy Ltd

Boiler with store and suction system
Image courtesy of KWB/Econergy Ltd

Underground storage tank with driveway manhole cover
Image courtesy of Geoplast

Underground storage tank with standard manhole cover
Image courtesy of Geoplast

Commercial Energy Cabin with side mounted solar thermal panels
Image courtesy of Econergy Ltd/Energy Cabin

Small commercial Energy Cabin with integrated solar thermal panels
Image courtesy of Econergy Ltd/Energy Cabin

3.1.3 Boiler dimensions

The dimensions of boilers vary considerably between manufacturers. The figures given below for minimum boiler room sizes are a guideline only and may not be applicable for some boiler manufacturers. Exact dimensions are available on request.

Boiler output (Kw)	Width (m)	Length (m)	Height (m)
10-30	2.5	3.5	2.5
40-100	3	3.5	2.5
150	3	4.5	3
200	5	5	3
300	5	7	3
500	5	7	3.5

3.2 Storage design and sizing

Each wood pellet boiler should be installed with its own storage silo or area. This section shows the different types of stores available, guidelines for correct sizing and access requirements.

3.2.1 Design

Wood pellets can be stored in a variety of ways depending on the requirements and restrictions of the site. All stores will require an auger or pneumatic delivery system to transport pellets to the boiler. Pellets can absorb air humidity therefore stores should not be ventilated.

A summary of solutions is given below:

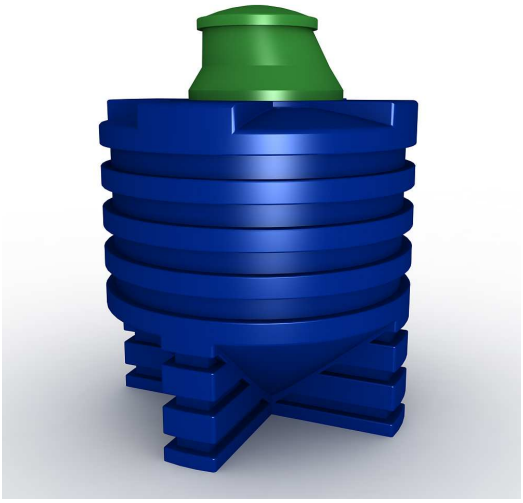
Storage solution	Advantages	Disadvantages
Fabric silo (bag system)	Ease of assembly No exhaust point	Must be protected from the weather Rarely includes facility for manual filling
Steel silo/ ISO container	Weather-proof	Potentially high cost, low aesthetics
Buried tank	Saves space Not visible	High cost Restricted maintenance access
Storeroom	Adjacent to boiler room, Can provide excess heat to ensure pellets stay in good condition.	Require space in cellar or dedicated room Must be built to withstand load and pneumatically blown pellets
Blockwork/wood panel room	Low cost	Requires building/ outhouse

Blockwork/Wood panel stores:
These stores will usually allow the most effective use of the storage space available. Aside from a fabric silo, all stores will require exhaust points to prevent over-pressurising during delivery. The diameter and connection of the exhaust pipe should be identical to the inlet pipe.

Blockwork store design considerations:

- 35° angle sloping floor to eliminate dead stock and avoid bridging over auger
- Exhaust pipe and inlet pipe with 500mm radius curves
- Friction-reducing lining for sides and floor
- Rubber baffle or cyclone to slow pellets on entry to store
- No exposed electrics inside the store

Fabric silo - Image courtesy of Geoplast



Buried tank – Image courtesy of Geoplast

3.2.2 Size

The level of recommended storage capacity will depend on boiler size, boiler use, available space, preferred delivery frequency and required fuel security (i.e. reserved stock).

In commercial situations it is recommended that a storage capacity in excess of six tonnes ($9m^3$) is available, to facilitate tanker deliveries. Where this is not feasible wood pellets can be delivered in bags which only require a small feed hopper. These are included with some boiler models.

The following are basic guidelines to designing pellet storage for non-domestic use:

- Minimum size 6 tonnes ($9m^3$)
- Bulk density is $0.65kg/m^3$
- Boilers above 150kw require at least 15 tonnes ($22.5m^3$) storage.
- For commercial users, storage should be designed to accept full tanker deliveries of 16 tonnes ($24m^3$), to keep deliveries to a minimum.
- Where it is feasible and economic to do so, it is recommended that commercial users have at least 30 days' stock-holding capacity.

Please contact us for further guidance on storage sizing.

3.2.3 Access

Access requirements will depend on the delivery method: bags or bulk.

Bags are sized between 12.5 and 25kg and are delivered on pallets of up to a tonne in weight. Couriers typically require access for trucks up to 10 tonnes.

Bulk deliveries are blown directly into storage from a pneumatic tanker along a flexible hose, and can be blown up to 30 metres from the storage connection although some vehicles will be limited to 8-10m. The distance between loading bay/waiting area and storage should be kept to a minimum to reduce the occurrence of mechanical degradation. Any bends required to reach the store should have at least a 500mm radius.

Degradation can also occur as the pellets are transported between the store and the boiler so this distance should also be kept to a minimum.

The delivery point should be accessible, and allow for the weight and dimensions of the delivery truck which are similar to those of a refuse truck (see table below). The route for access should not have weight or height restrictions, such as low bridges or overhead lines.

Typical delivery tanker dimensions:

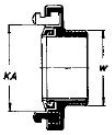
Width	3.0 m (Inc mirrors)
Height	4.0 m
Length	9.5 m
Wall-to-wall turning circle	19.8m
Payload	16 tonnes
GVW (Gross Vehicle Weight)	26 tonnes
Delivery pipe fitting	Storz 110-A
Delivery pipe diameter	100mm (4”)

These dimensions may vary by location and delivered quantities. Please contact us for access requirements for specific sites.

Wood pellet tanke and wood pellet delivery in progress at college (far left)

Connections – Storz 110-A:
This type of connection is a two-way or sexless airtight connector. They are used to connect the delivery vehicle hose to the wood pellet store. Adapters are available for use with other types of connector including cam lock and URT.

As shown below Storz connections are available as both female (left) and male (centre) threaded couplings are available. To ensure the stock of wood pellets is kept free of moisture a blank cap (right) should be fitted to the open pipe when not in use.



The coupling should be securely fastened and unable to twist.

4. Usage and maintenance

4.1 Boiler maintenance

A typical maintenance contract will include one or two services a year, although maintenance periods vary by manufacturer. Service contracts are available from boiler installers.

4.2 Ash disposal

The combustion of wood pellets typically produces less than one per cent ash, depending on the type of material from which the pellets are produced, how well the appliance is set up and the type of boiler.

Ash is deposited at the base of the boiler grate/ burner and in the heat exchanger tubes of the boiler, and may be trapped at the base of the flue. Boilers may be equipped with additional automatic ash handling facilities which vary between manufacturers and models. These can include automatic de-ashing, heat exchanger cleaning and ash compacting.

Ash produced from virgin wood is mainly composed of potash – a commercial fertiliser. The material is inert and can be safely handled, although should be disposed of in accordance with the Waste Directive. Larger quantities of ash will normally be disposed of by arrangement with the boiler installation/service company or with a specialist ash removal company.

Face masks or similar should be used to avoid inhalation in periods of continued exposure as the ash is very fine.

4.3 Fuel deliveries

When ordering fuel the site/maintenance manager should check whether the agreed access point to the loading bay or waiting area is clear of obstructions and that the store can accept the agreed fuel delivery.

4.4 Fuel quality

The quality of the fuel used can have a significant impact on the reliability and life of the boiler. Attention should be paid to the recommended specification given by the boiler manufacturer which may vary depending on the country of origin.

Off-specification pellets can contaminate stocks of good material, and may be difficult to dispose of. The use of contaminated material can lead to breaches of emissions and waste regulations.

The European standards have been developed based on the work of CEN's TC335 solid biofuels committee. The UK mirror committee is BSI PTI/17. The fuel specification DD CEN/TS 14961 standard, shown below, is for a typical high-quality pellet, which can be used in domestic situations.

Energy density	4.8 kWh/kg.
Dimensions	≤ 6 mm ± 0.5 mm and L ≤ 5 x diameter or ≤ 8 mm ± 0.5 mm, and L ≤ 4 x diameter
Origin	Chemically untreated wood without bark
Moisture content	≤10 %
Ash content	≤ 0.7%
Sulphur content	≤ 0.05 %
Mechanical durability	97.5% after testing
Amount of fines[†]	≤ 2.0 %
Additives[‡]	< 2 w-% of dry basis

4.5 Safety/handling

Care should be taken to avoid the generation of dust during delivery and use of pellets which may create an explosion hazard. This is best achieved by:

- Using permanent connectors for hoses.
- Providing dust filters for tank venting.
- Installing deflectors or baffles to dissipate energy in storage.

Because of the relatively large dust particle size, the risk of explosion is low. However, face masks should be worn by operators to avoid the inhalation of dust. Similar precautions should be taken when handling ash.

Wood pellets are flammable, but are inert under normal conditions. Point sources of heat (light and electrical fittings) should be kept away from storage. Naked flames should not be present during loading and discharge of pellet fuels, and non-smoking rules should be applied.

Spillages of pellets can be recycled back into storage, provided that the fuel has not been contaminated by grit or chemicals.

Pellets are designed to have sufficient strength to be delivered and stored, while remaining easy to break down during combustion. However, repeated handling will cause the pellets to break down to sawdust. Most boiler systems can handle a significant proportion of sawdust but, for optimal efficiency, handling should be minimised.

A typical delivery by pneumatic tanker of around 16 tonnes should take less than half an hour. Safety precautions should be taken to avoid injuries to staff and passers-by during the manoeuvring of trucks and from tripping over hoses. The delivery point should be at a height that is easily accessible and free of any obstructions.

Wood pellets are highly absorbent and can be used to clean up spillages of liquids. Any material used in this way will not be suitable for combustion.

[†] Percentage, by weight, of material smaller than 3.15 mm. Measured at the last possible place in the production site.
[‡] Percentage, by weight, of pressing mass (material introduced to pelleting dye. This may include glues, pressing aids and slagging inhibitors.

Appendix 1 – Further reading

The following documents are available for download from the Forever Fuels website: www.forever-fuels.com

Biomass Task Force: Report to government; Sir Ben Gill, October 2005

Government response to the Biomass Task Force; April 2006

Building regulations 2006:

- **Part J:** Combustion appliances and fuel storage systems
- **Part L:** Conservation of fuel and power

UK Biomass Strategy; DTI, DEFRA & DfT, May 2007

The following are available through the internet:

Carbon Emission Reduction Target (CERT); Defra.gov.uk

Planning Policy statements (PPS22,PPS11,PPS12) – www.planningportal.gov.uk

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