MIDLAND BIO ENERGY

PRE-DELIVERY AND DESIGN CHECKLIST FOR WOOD PELLETS - COMMERCIAL CLIENT

The following guide is written for specifiers, clients and boiler installers. Its intention is to give an insight to how we produce high quality pellets and what we offer as pellet delivery systems. It is also written to ensure that potential problems in using wood pellets as a fuel are minimised and that the appropriate design features for pellet silos and pellet deliveries are included.

SUMMARY

- Does your site have access for a truck delivery - dimensions 10m(30') (L) x 3.6m(12') (H) x 2.6m(8'6") (W)

- Is the distance from the lorry to the pellet store within 12 metres – horizontal or vertical? This is the maximum we normally recommend.

- If the distance is greater than 6m but less than 12m we can deliver, but a site inspection would be needed to determine the extent of potential damage to the pellets from blowing at higher pressure. A client disclaimer accepting some damage to the pellets may need to be agreed.

- If the pellet silo is on an above ground floor or in an industrial tall silo, we can also offer a 20m delivery distance with guarantees. There needs to be a 'soft' bend at the top of the delivery route into the silo. During the very first delivery to a tall silo there could be some damage to the first pellets. This can be avoided by hand positioning some bagged pellets at the base to cushion the pneumatically delivered fuel load. If this is not possible then some limited damage to pellets is possible but this should have passed through the boiler system during the commissioning. Thereafter the client should ensure that the silo is not empty before a new delivery is made to minimise damage.

- Have you fitted at least two Storz A (or Cam-lock A400) fittings to enable the lorry to blow into the store and allow delivery air and dust created during delivery to escape? The second inlet can also be used to distribute the pellets more evenly across the pellet silo.

- Is the Storz A or Cam-lock fitting within the driver's reach? (Chest height or lower is recommended). A pellet inlet pipe that requires a delivery driver to climb a ladder or platform is not acceptable.

- If there are extension inlet pipes into the store, such as in a longer, narrow store, they should be positioned approximately 20% and 50% along the length of the store to ensure even distribution of pellets in the silo.

- In a square shaped silo a passive cyclone system can be fitted from the ceiling to allow even distribution of the pellets in the silo.

- Is your store waterproof all year round and sufficiently vented via an exhaust pipe to allow dust to be removed when pellets are delivered?

- Is there sufficient ventilation in the store to prevent condensation build-up? This is particularly important with underground silos.

- In damp and cold climatic conditions, metal stores and hoppers located outside can create moisture on the inside walls due to temperature variations. Having ventilation to remove moisture inside the silo is helpful. Vent pipes are useful, making sure they have filters on the end to prevent dust escaping. Insulating the connecting auger pipes from the outside silo to the boiler room is a practical way of minimising condensation on the inside of these augers.

- Metal hoppers, containerised silos or silos located outside can be improved by building a simple wooden skin inside the walls. Again this minimises moisture creation and dampness spreading into the pellet fuel.

- Is the store air tight to prevent dust migration? This includes waterproof sealant at corners, joints, access points for pellet pipes and maintenance doors. A double Z-seal is advised for any access and maintenance doors.

- Is your store of sufficient strength to hold at least 10 m3, approximately 6 tonnes, of wood pellets? The We minimum for blown delivery is 4 tonnes and the lowest prices are available for loads of 16 tonnes or above so - **Bigger is Better**.

- To calculate effective pellet silo volume, assume that only 65% of the total volume of the space is 'useful' volume for pellets once an inclined base is constructed.

- Is there a minimum floor slope of 40o towards the feed/auger mechanism?

- Does your store have sufficient volume for at least three weeks storage? This allows less frequent deliveries. For larger projects a more frequent delivery is viable but taking account of holiday periods and bad

weather, bigger storage does increase the flexibility of fuel ordering for the client.

- How many bends has the pellet intake pipe got? Two or less are recommended. Make sure the bends are 'soft', minimising pellet damage, with a radius of no less than 300mm and ideally 500mm. We can deliver pellets with greater than 2 bends, but each additional bend increases damage to the pellets. We may have to assess the design where there are more than 3 bends. For all commercial projects we will visit the pellet silo anyway to assess its practicality for use.

- Has your store got a flexible rubber cushion mat hung opposite the inlet pipe and in front of any far wall? This will limit pellet damage during delivery - it is essential that pellets are not blown against a wall or hard floor. The mat should **not** be placed immediately in front of the pipe but in front of any hard surface where the pellets are directed.

- Is your store free of electrical sockets, electrical fittings, lights and switches to prevent possible explosion in the event of fine dust build up? Where electrical lights are fitted, they need to be with fully safety provision to ensure no sparks can occur in the silo.

- During pellet delivery, all lights should be switched off and for at least an hour after delivery.

- Has your silo design been assessed for potential explosion risk? Carrying out a risk assessment is a useful process for checking design proposals and engaging with a responsible pellet fuel provider. Though there is an extremely low risk if design good practice is followed, where fine dust may be created there is a potential for explosion.

- An explosion risk mitigation assessment should include issues such as: earthing the pellet delivery pipes and delivery vehicle, the absence of electrical appliances in the silo, airtightness, and separation between silo and boiler room. A clear three-pronged strategy should focus on 1) specifying Grade 1 quality pellets, 2) minimising dust creation through good design (e.g. pellet fill pipe work, cushion mats), and 3) reducing ignition possibilities via earthing the pipe work and keeping electrical equipment away from the internal pellet store. It may be appropriate, in the very rare event where an explosion is felt to be possible, to provide relief for the potential blast pressure created. Reference should be made to the DSEAR 2002 regulations (The Dangerous Substance and Explosive Atmosphere Regulations) and BS EN 14491:2006 'Dust Explosion Venting Systems'.

- A post installation check should be made by the consultant and client representative of the pellet silo and other related pellet fuel delivery measures, including the potential for dust explosion, to ensure that they have been installed properly to the proposed design.

- If your fuel handling system is primarily for wood chip fuel it can usually be utilised for wood pellet systems as well. This includes rotary agitators, walking floors and hook bin systems. There may be weight restrictions on fuel capacity however as wood pellets are more than 3 times as dense as wood chip.

- What is the length of the pellet auger? Auger runs longer than 8-10m may require a second auger to avoid pellet damage.

- At the annual or major service the pellet silo should be allowed to empty and cleaned out. Any residual dust on walls, the inclined floor or in the auger should be cleared to ensure there is no build-up over time.

- Prior to and during the delivery, access for the delivery vehicle must be assured, with appropriate use of cones to exclude parked vehicles that may inhibit this.

Disclaimer: *This Design Guide is provided purely to assist designers and clients in avoiding poor design choices for pellet silo and delivery, which subsequently cause operational difficulties and potentially increase the running costs of the pellet boiler system. It is not intended to offer full design guidance or specific guidance on a unique project and we do not accept any liability for the views expressed in the Guide. Nor is it intended to give detailed legal advice on relevant regulations and legislation. The individual circumstances of each project must always be considered by the consultant or designer and further detailed advice sought where appropriate.*

Pellet silo design

Pellet silos can be constructed in a variety of ways. These include pre-constructed modular metal (tall or low) or plastic systems, flexible bag systems, hook bin sand containers, or bespoke constructed silos in block work, brick and wood inclined base. We have delivered pellets to a wide variety of pellet silos so we have extensive experience over what type of silo works and what does not. The critical aspects of pellet silos for effective design and trouble-free operation are:

Volume Calculation

- Design the silo with sufficient volume to minimise the frequency of deliveries and access the cheapest price for fuel. The cheapest fuel options are for 16 tonnes or above. Taking account of the reserve in fuel needed when ordering new fuel, this requires an effective volume of 30m3. 1 tonne of pellets occupies 1.65m3 volume.
- To calculate the effective volume of a fuel silo, assume that only 65% of the gross volume of the silo space is available after the inclined base is installed.

Dust Creation and Potential Explosion Risks

- All silos should include a rubberised cushion mat in front of any hard surface such as a wall to prevent damage to the pellets on delivery (see Figure 2 below).
- Sharp angles and surfaces should be avoided to reduce the potential for making dust, as should void areas where dust can collect.
- Dust and any associated explosion risks should be taken account of when designing the silo. **A three-pronged risk mitigation strategy** should be developed. This means a strategy based on 1) procuring quality wood pellets to minimise disintegration and fines (pellet providers should be manufacturing to the CEN TS14961 standard or equivalent, with a total quality approach to manufacturing), 2) designing a pellet silo and delivery route that minimises dust creation, and choose a pellet provider with trained drivers who deliver at an appropriate pressure and 3) reducing dust ignition by ensuring that no electrical appliances such as lighting and electrical cables are located in the silo (or if they need to be included they are fully shielded to prevent sparks), and that pellet fill pipes and the delivery vehicle are earthed.
- The dust explosion risk mitigation strategy should ensure that there is clear separation between the silo and the boiler room; that the silo is air tight or a filter is available around any vent; that pellet fill pipes do not have many sharp bends causing pellet disintegration and dust, and that a cushion mat is fitted to prevent pellets hitting hard surfaces. To mitigate any potential explosion, however remote that may be, explosion relief such as blast panels to the exterior world could be assessed for possible incorporation where that might be appropriate. The appropriate DSEAR regulations for explosive substances should be consulted, as should BS EN 14491:2006 for design of dust explosion venting protection systems.

Moisture Minimisation

- Metal containers and hoppers can create condensation on surfaces during wet and cold weather. To minimise this and the dampness that can damage the pellet fuel, a wooden skin can be simply constructed inside the walls. In addition, vent pipes to prevent condensation build up should be considered, particularly for larger silos. Such vent pipes can be passive systems, but they should have a filter to prevent dust escape during pellet filling.
- Where an external silo is connected to the inside boiler room via augers, the auger should be insulated to prevent condensation.

Pellet Level Inspection and Sensors

- Sight glasses at a range of height levels in the silo are useful for visual inspection of pellet levels to avoid the client running out of fuel (see Figure 1).
- Infra-red systems or proximity switches are highly recommended to highlight when a) pellet levels are full (i.e. preventing over-filling) and b) levels are low, requiring reordering. Low-level pellet indicators should let the client know when there is less than 30% of the full volume left.

Access and Maintenance of Pellet Silos

- Silos need access points for internal maintenance, including sucking out pellets and servicing pellet augers. This should as a minimum be a 750mm by 500mm set high up on one of the four walls of the silo. This will need to open away from the silo to the outside. A set of wooden slatted panels set in metal runners in front of the access door is needed to keep pellet weight away from the door (see Figure 1 below).
- A double seal door is needed to prevent dust escaping. During the major or annual service, pellets should be emptied from the silo and any residual dust on walls, floor and in augers cleaned out.

Hybrid chip and pellet systems

- Chip fuel silo and handling systems such as rotary agitators or walking floors can usually be utilised for wood pellet fuel. However, if these systems have a weight or height of chip restriction, these need to be adjusted for the much denser pellet fuel. For example if a 3m diameter rotary agitator system has a height restriction of 3m for chip fuel – i.e. total weight in the silo of 5-6 tonnes (20m3 by volume) then no more 10 m3 (6 tonnes) of pellets should be supplied. Similar restrictions can apply with walking floor systems to avoid hydraulic ram systems operating beyond design specification.

Figure 1 – Pellet Level Sight Windows

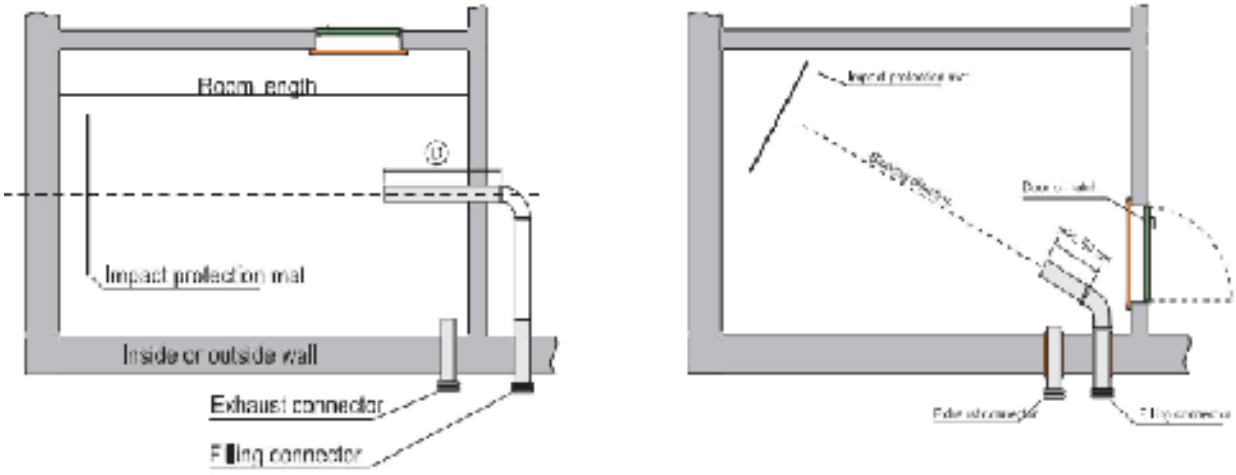


Figure 2 – Pellet Impact Protection Mat Location

High Level Access Door to Silo

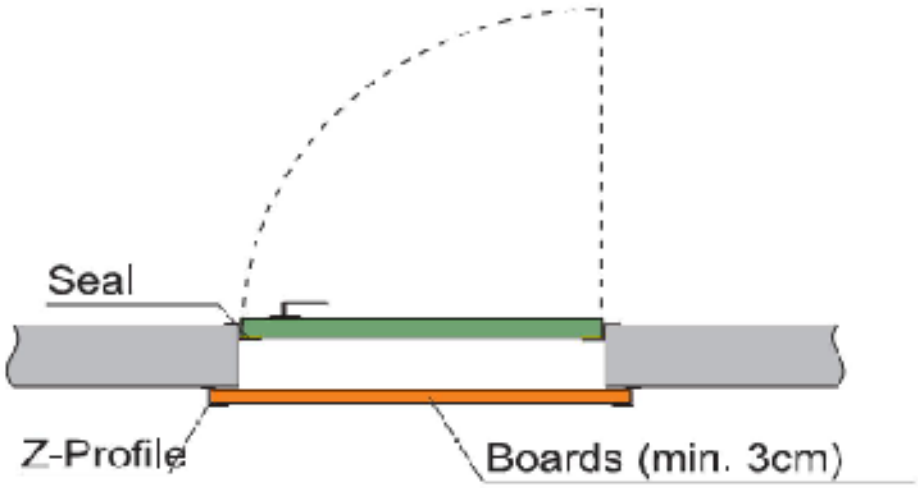


Figure 3 – Pellet Silo access door with effective Z-profile sealing and board protection

Pellet Pipes – Filler and Exhaust

- There needs to be at least two pellet inlet and exhaust pipes to a silo. These allow pellets to be both pneumatically blown into the silo, and also air and dust to escape. Dust should be captured by a dust bag or an extraction system. If the silo is relatively long (i.e. greater than 3m long) then the pipes can be used as twin fill pipes with the fuel delivery split between each pipe. To ensure adequate filling, the end of the pipes should be set approximately 20% and 50% along the longest length of the silo.
- Some older pellet stores which are amended coal stores have had passive centrifuge systems fitted in the ceiling to allow even distribution across the silos. If the shape of the store is such that it is more difficult to fill easily from single or even twin pellet fill pipes, then additional fill pipes should be fitted.
- To minimise pellet disintegration and dust creation, the number of bends in the pellet inlet pipes should be minimised. Ideally these should be no more than 2 bends. The bends should be 'soft', i.e. no less than a radius of 300mm and ideally a 500mm radius to minimise damage. There should be at least a 500mm straight length between bends.
- If there are more than 2 bends in the system, we will need to inspect the design and site to ensure that undue damage is not caused.

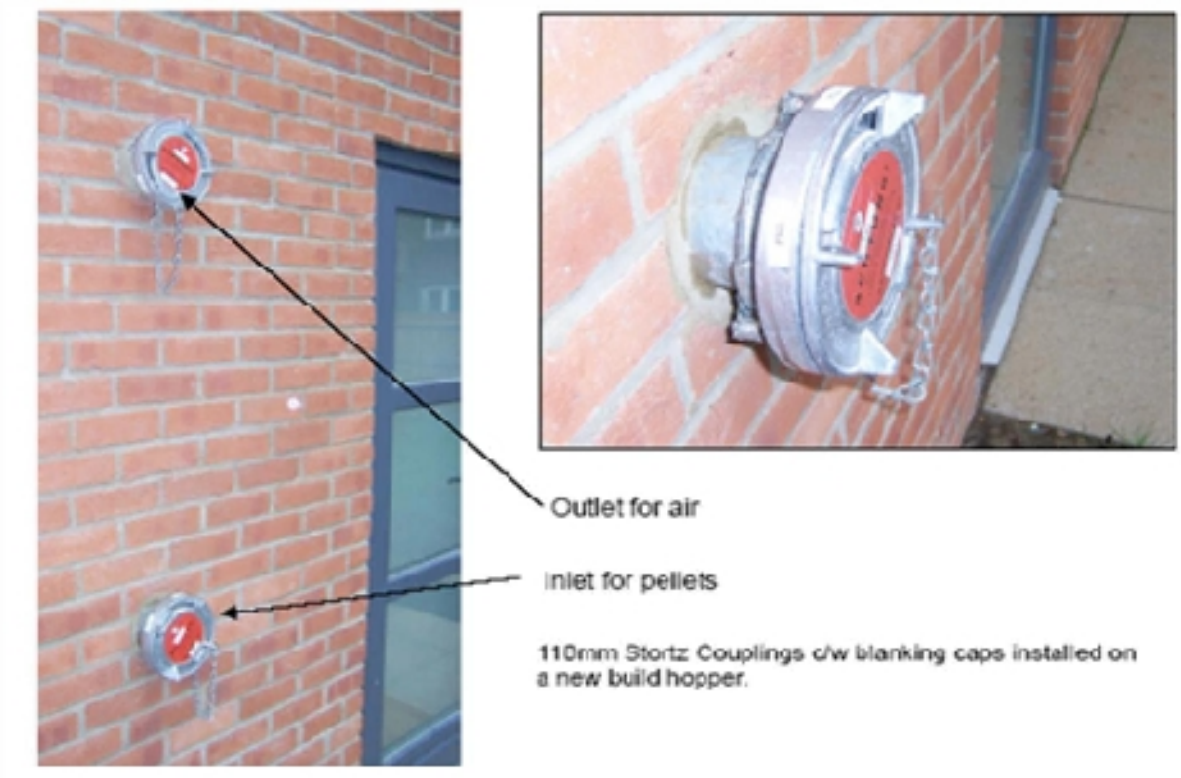
Pellet Delivery Vehicles and Deliveries

The pellet capacity of the delivery vehicle is 18 tonnes and the total weight of the vehicle when fully loaded is 32 tonnes. They can offer up to 30 m delivery from the vehicle, but we strongly recommend a distance of no more than 20m from the vehicle to the silo inlet pipe. The vehicle has an on-board weighing system.

Access can be an issue for deliveries particularly in sensitive sites such as schools and community centres. Specifying ‘no-go’ times for deliveries and also marking off the previous day parking which may block the delivery vehicle, are important in ensuring a smooth trouble-free operation.

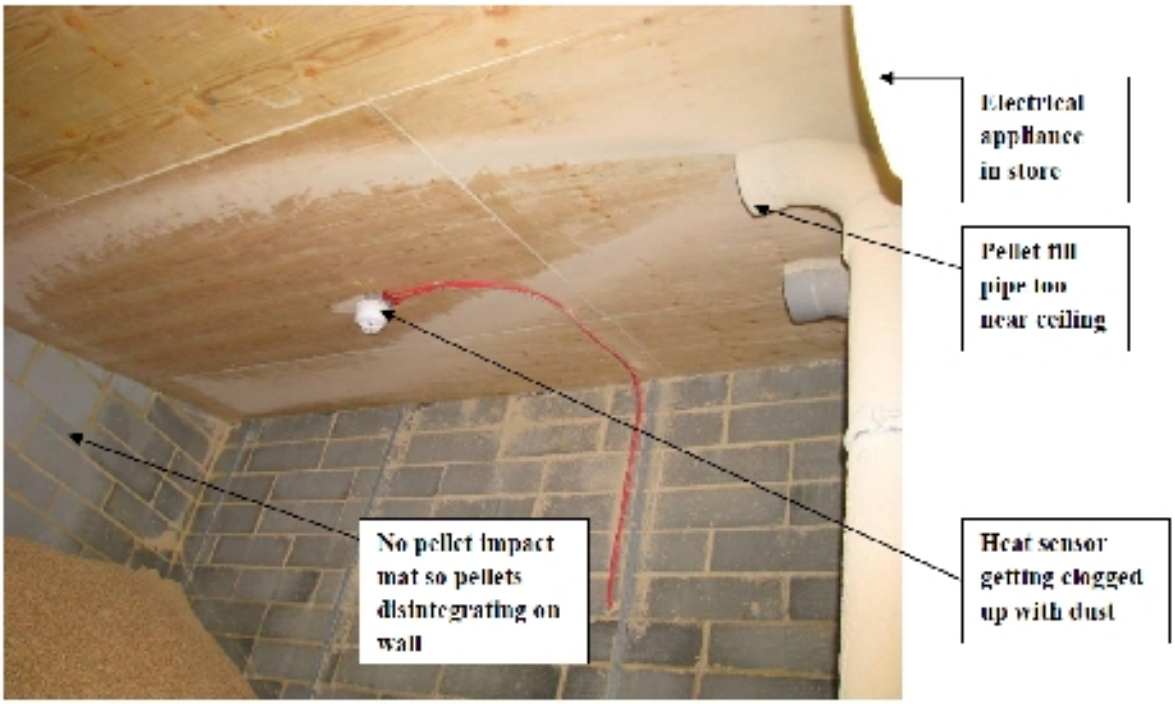
Safety can be an issue when delivering. A number of boiler systems which use pneumatic delivery need ‘isolation’ (i.e. the boiler switched off) when deliveries take place. Boilers are usually labelled as such and the issue is usually identified during the pre-delivery site visit.

Pellet delivery in action



Pellet Fill and Exhaust Pipes (Storz A fitting) on outside of Pellet Silo

Possible installation faults that may occur include:



Multiple faults with silo design – fill pipe too near ceiling leading to impact and dust, no impact mat on rear wall leading to disintegration, and heat sensor in flight path of pellets leading to disintegration, dust into the sensor (and hence compromising the fire alarm), plus electric lights and cable into silo leading to explosion risk

Emergency Access Door to Silo with sight Glass. Door not properly sealed so allowing dust to escape. It opens internally to silo which prevents access when silo is full and the sight glass is too small to be useful.

Twin Pellet Delivery Pipes with Impact Cushion Mats. The mats are too close to the pipes and will reduce the filling capacity of the silo.

For further information, please do not hesitate to contact Andy Brindley on:

Phone: **07792 804524**

Email:

andy@midlandbioenergy.co.uk

Website:

www.midlandbioenergy.co.uk