

Guidelines for designing a wood pellet storage facility

Translated by Pieter D. Kofman¹

These guidelines outline German industry recommendations for the location and construction of storage facilities for wood pellets. They are reproduced with permission of the German Energy Pellet Association.²

General

Tip: *The quality of the fuel used will determine how well the pellet boiler functions. Only quality pellets produced according to CEN TS14961:2005 Table 5 are recommended for use as fuel. It is recommended that wood pellets are purchased only from suppliers that have certified quality fuel.*

Danger: *Before filling the pellet storage room, the boiler must be switched off.*

The location of the pellet storage room

Wood pellets are generally delivered by a silo truck, from which they are blown into the storage room. The silo truck should be able to come as close as possible to the filling connection, to minimise damage to the pellets during off-loading. Silo trucks usually have pumping hoses that are a maximum of 30 m in length. Therefore, the pellet storage room (or the outside connectors or bag silo) should be situated a maximum of 30 m from the place where the truck can park. If the pumping hose has to be longer, the supplier should be consulted to clarify whether this can be accommodated.

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Tip: *For transport and off-loading (through a pressure hose) of the pellets, the recommendation is to use hoses that have been coated with Teflon on the inside to reduce damage to the pellets.*

Access

The entrance road should be at least 3 m wide with an unobstructed height of at least 4 m. If possible, the storage room should adjoin an outer wall, to allow access to the filling connectors from the outside. In any case, there should be enough room to manoeuvre while attaching the filling hose to the connectors.

Care should be taken to ensure that the filling hose does not kink at the filling connector.

The storage room must be easily accessible for necessary maintenance and cleaning work (see Figure 1).

Construction of the storage room

The size of the storage room

An oblong/rectangular storage room has proven to be the best shape. The filling and exhaust connectors should be placed in the narrow side of the room. Good access to the connections is vital.

The required size of the storage room depends on the heat load of the building, but should be large enough to store the total annual fuel requirement.

If waste volume is taken into consideration, follow the rule of thumb given in Figures 2 and 3.

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² This document was translated and adapted, with permission, from the publication 'Empfehlungen zur Lagerung von Holzpellets', produced by the Deutscher Energie-Pellet-Verband e.V. (DEPV), Germany (www.depv.de).

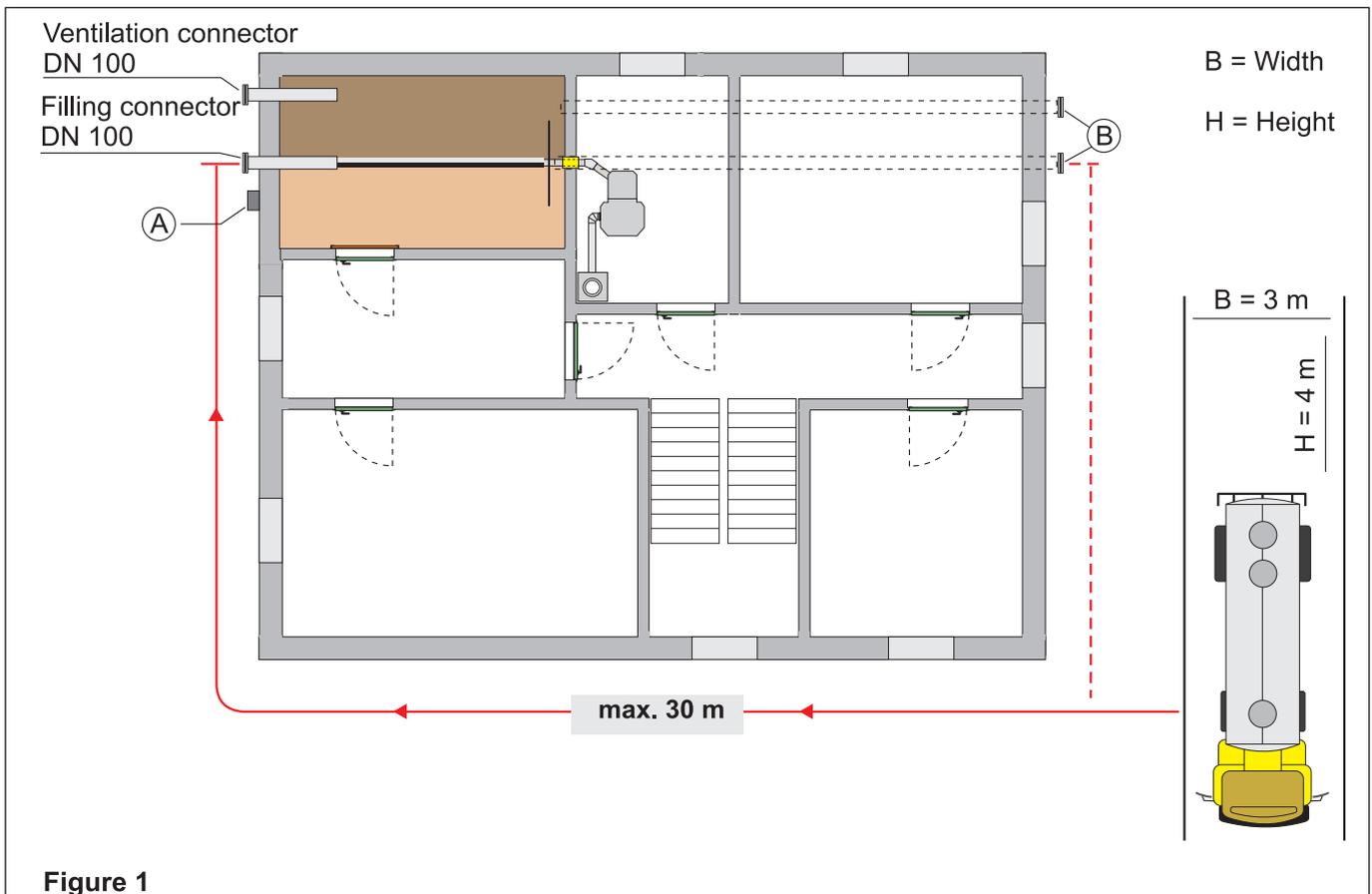


Figure 1

Ⓐ **Extra equipment:** 230 Volt electrical outlet for the exhaust ventilator of the pellet delivery and/or the cut-off switch of the boiler.

Ⓑ **Tip:** An alternative route for the filling pipes inside the building can shorten the required hose length.

RULE OF THUMB:

Per kW heating load = 0.9 m³ storage space (including empty space)

Useable storage space = $\frac{2}{3}$ of the storage space

1 m³ pellets ≈ 650 kg

Energy content ≈ 5 kWh/kg or 18 MJ/kg

Example: A single family house with a heating load of 15 kW = 5.800 kg wood pellets/year

15 kW heating load x 0.9 m³/kW = 13.5 m³ storage space (incl. empty space)

Useable storage space volume = 13.5 m³ x $\frac{2}{3}$ = 9 m³

Amount of pellets = 9 m³ x 650 kg/m³ = 5.850 kg ~ 6 t

Size of pellet store = 13.5 m³ : 2.4 m (height of room) = 5.6 m² storage room surface (2 x 3 m minimum)

Stored energy amount = 5.850 kg x 5 kWh/kg = 29.250 kWh (equals about 3,000 litre fuel oil)

Figure 2

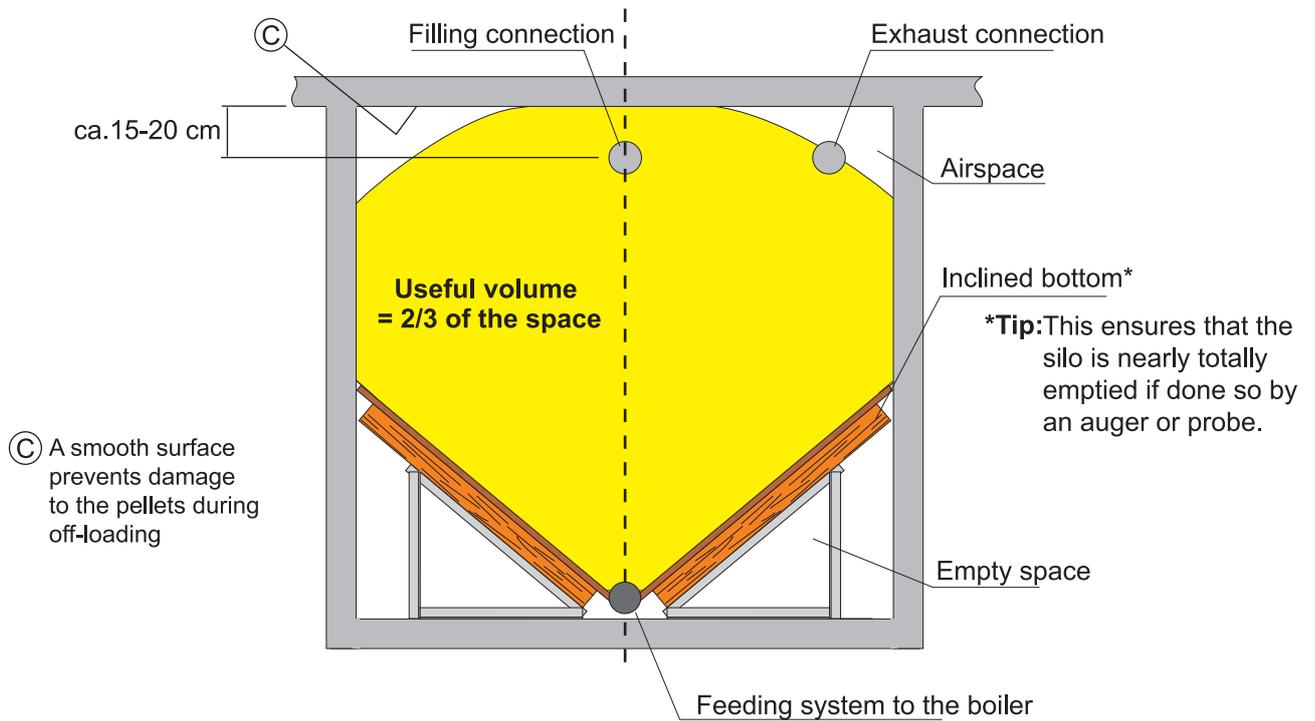


Figure 3. Useable volume of a pellet storage room (side view).

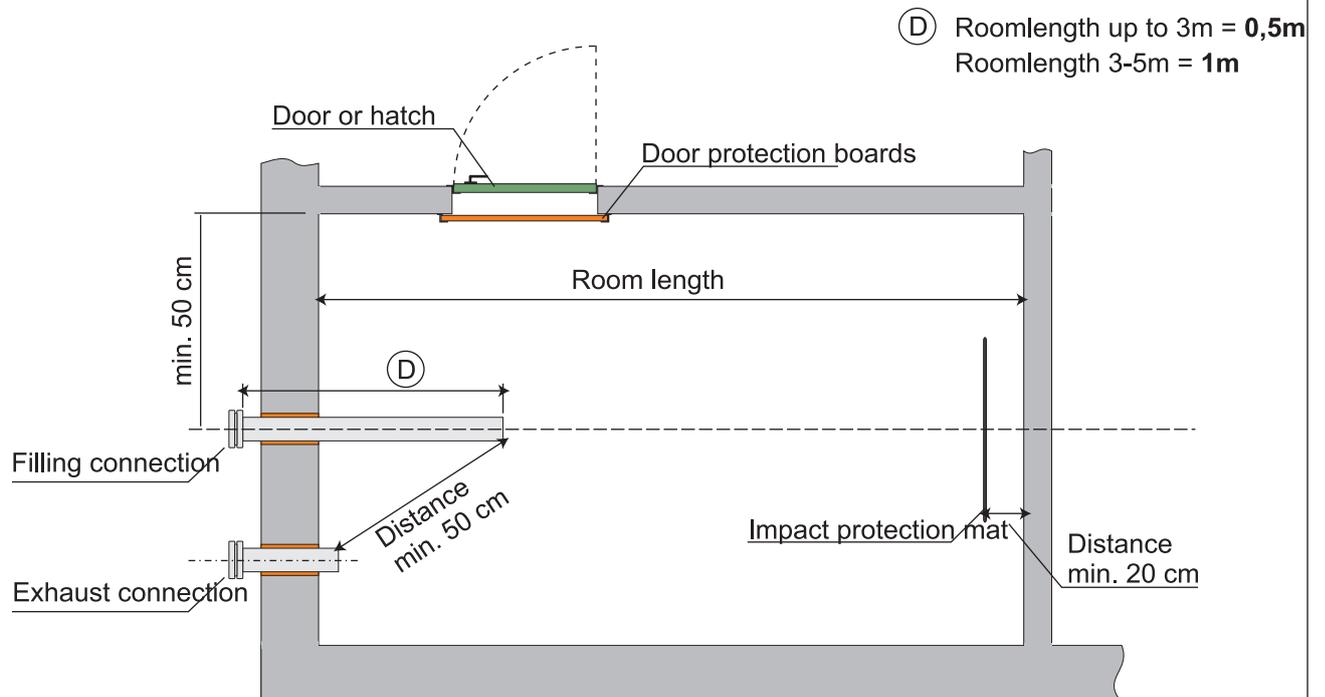
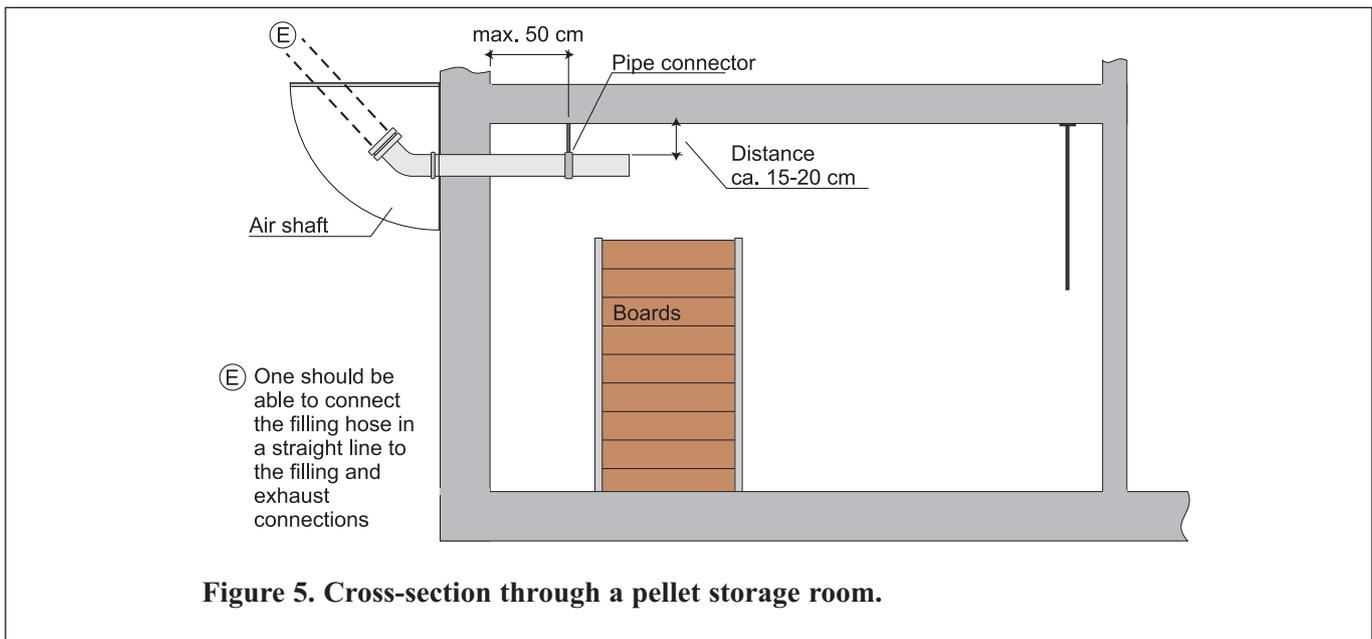


Figure 4. Footprint of a pellet storage room.



Protection against moisture and water

Tip: *Pellets are hygroscopic. In contact with water or moist walls and floors, the pellets will swell and fall apart and become useless. Wet pellets can also block the infeed mechanism.*

The pellet storage room must be dry throughout the year. In newly built houses the storage room must be allowed to fully dry out before it is filled.

Normal air moisture, such as indoors, should not damage pellets.

If there is a risk of moist walls (even temporarily) a special silo should be used.

Structural requirements for the pellet store

Warning: *The walls around the store room should be designed for a weight load corresponding to a pellet bulk density of $\sim 650 \text{ kg/m}^3$.*

The ceiling and the walls should be constructed and finished so that contamination of the pellets does not occur by abrasion or crumbling.

Thickness of walls

In practice the following wall thicknesses³ have proven to be sufficient:

- Concrete 10 cm;
- Brick 17.5 cm thickness, plastered on both sides;
- Timber frame to standard, with skimmed plaster board to the inside.

Equipment in the storage room

Doors and hatches

Tip: *Doors and hatches should be sealed to prevent dust from entering other rooms.*

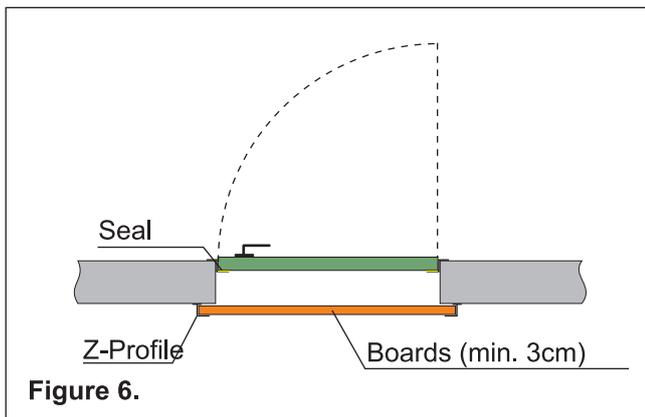
Doors and hatches should open to the outside and should have a dust-proof seal all the way round.

Wooden planks must be used on the inside of doors or hatches to the pellet store so that the pellets do not touch the door or hatch. The door lock should be dust-proof sealed from the inside (Figure 6).

Visual inspection facilities to check the degree of filling (e.g. dust-proof inspection holes in the wooden boards) are recommended.

If possible, the door should be in the vicinity of the filling connector. This ensures that entry to the pellet store is available for a period during delivery, as the pellets will build up against the far wall when blown in.

³ Wall lengths of max. 5 m, height 2.5 m and well bonded to the floor and ceiling.



Inclined bottom

Tip: *The storage room should have an inclined base, constructed so that the silo will be emptied completely (Figure 7).*

The angle of the inclined base should be between 40 and 45 degrees, so that the pellets can slide down (Figure 7).

The inclined base should be made of wooden sheet materials with a smooth surface (such as coated fibreboard or particle board. OSB sheets have a fairly rough surface and should be sanded smooth if used). The sides of the pellet removal conveyor should have no edges or grates that prevent the pellets from falling into it.

The inclined base should be connected to the surrounding walls in such a way that no pellets can fall into the empty space (from which they usually cannot be retrieved).

The inclined base should be able to cope with the static load of the weight of the pellets (bulk density $\sim 650 \text{ kg/m}^3$). A stable foundation is essential. Suitable angle irons can be used for the construction of the inclined base. There should be a maximum distance of 60-70 cm between supports (Figure 7).

The connection of the inclined base to the outfeed system should be made according to the instructions of the firm that has delivered the outfeed system.

Noise protection

Tip: *The construction of the inclined base, the outfeed system, as well as the passages through walls, should be constructed in such a way that transfer of noise is prevented.*

Impact protection mat

Tip: *It is essential to install an impact protection mat made of wear- and rip-proof material. The mat should be installed at right angles to the direction that pellets are blown in, close to the far wall opposite the filling connector. The mat should be inspected the first time the storage room is filled to see if it performs according to requirements.*

The impact protection mat (e.g. 1250 x 1500 mm) protects the pellets from being damaged on impact with the rear wall. The mat also protects the rear wall from damage.

Examples of suitable impact protection: high density polyethylen foil at least 1 mm thick, or wear-proof rubber with a thickness of 1-3 mm.

Objects in the pellet storage room

Tip: *Any existing objects that cannot reasonably be removed from the storage room, such as sewage pipes, central heating system pipes, that may hinder the trajectory of the pellets during filling, should be shielded by sheet metal. Rectangular shielding should be avoided as this can damage the pellets.*

Electrical installations in the storage room

Danger: *There should be no electrical installations such as switches, lights, connectors in the pellet storage room.*

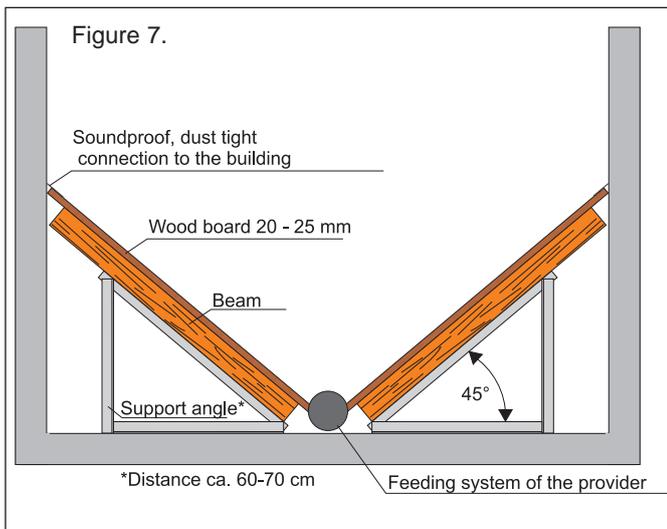
Filling system

Filling and exhaust pipes

A filling connector and an exhaust connector are needed in any pellet store. The function of the connectors should be clearly and permanently marked (e.g. wood pellets).

‘Storz Type A’ have proven their worth as standard connectors for the delivery vehicle (see photo).





The connectors should be installed 15-20 cm from the ceiling of the storage room (measured from the ceiling to the top of the connector).

The filling pipe should protrude about 2% of the length of the pellet storage room. After a maximum of 50 cm, a connector for the filling pipe should follow (Figures 4 and 8).

If the filling connector is situated in an air shaft, it should point in a straight line out of the shaft (Figure 8).

Tip: *The filling connector should be solidly fixed in place so that it cannot twist when the filling hose is connected.*

Danger: *The filling connector should be connected to earth with a 1.5 mm² earth wire. The earth connection is needed to prevent the build up of an electrostatic charge during filling.*

Type of filling system

Warning: *Only metal pipes should be used for the filling system.*

The filling system should be earthed to prevent electrostatic charges.

Pipes and bends should have a smooth inner surface to prevent damage to the pellets during filling. Items such as screws may not protrude into the pipe, as these may damage the pellets.

The filling pipes should be as short as possible (not longer than 10 m) and should have as few changes of direction as possible. If the direction is changed by more than 45 degrees, only bends with a radius of more than 200 mm should be used.

The filling pipe should not end in a bend, but in a straight pipe of at least 50 cm to let the pellets settle.

The connector and the diameter of the exhaust air pipe should have the same dimensions as the filling pipe.

After filling, the connectors should be closed with a proper lid.

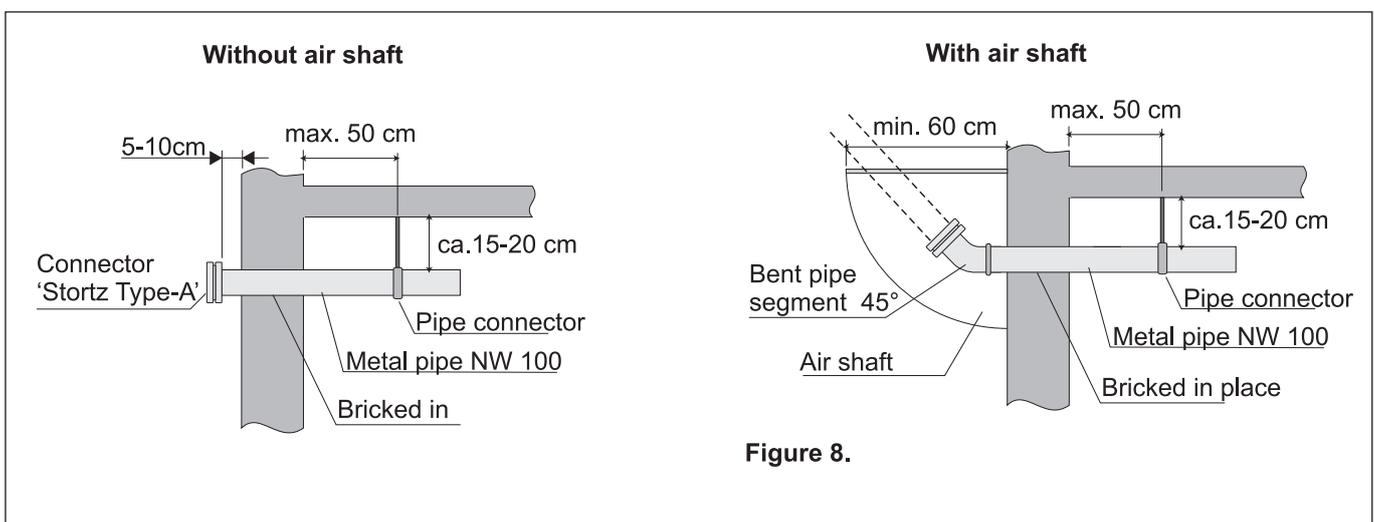


Figure 8.

Power outlet

Tip: A power outlet with 230 V and a fuse of 16 A should be available outside the storage room for the pellet supplier.

Special equipment

It is recommended that a 'house connection box' be installed close to the filling connector.

The 'house connection box' should contain the 230 V power outlet for the exhaust ventilator of the pellet supplier. The box should be equipped with a door switch that can disconnect the boiler. This prevents smoke from being drawn from the boiler by the exhaust ventilator (Figure 1).

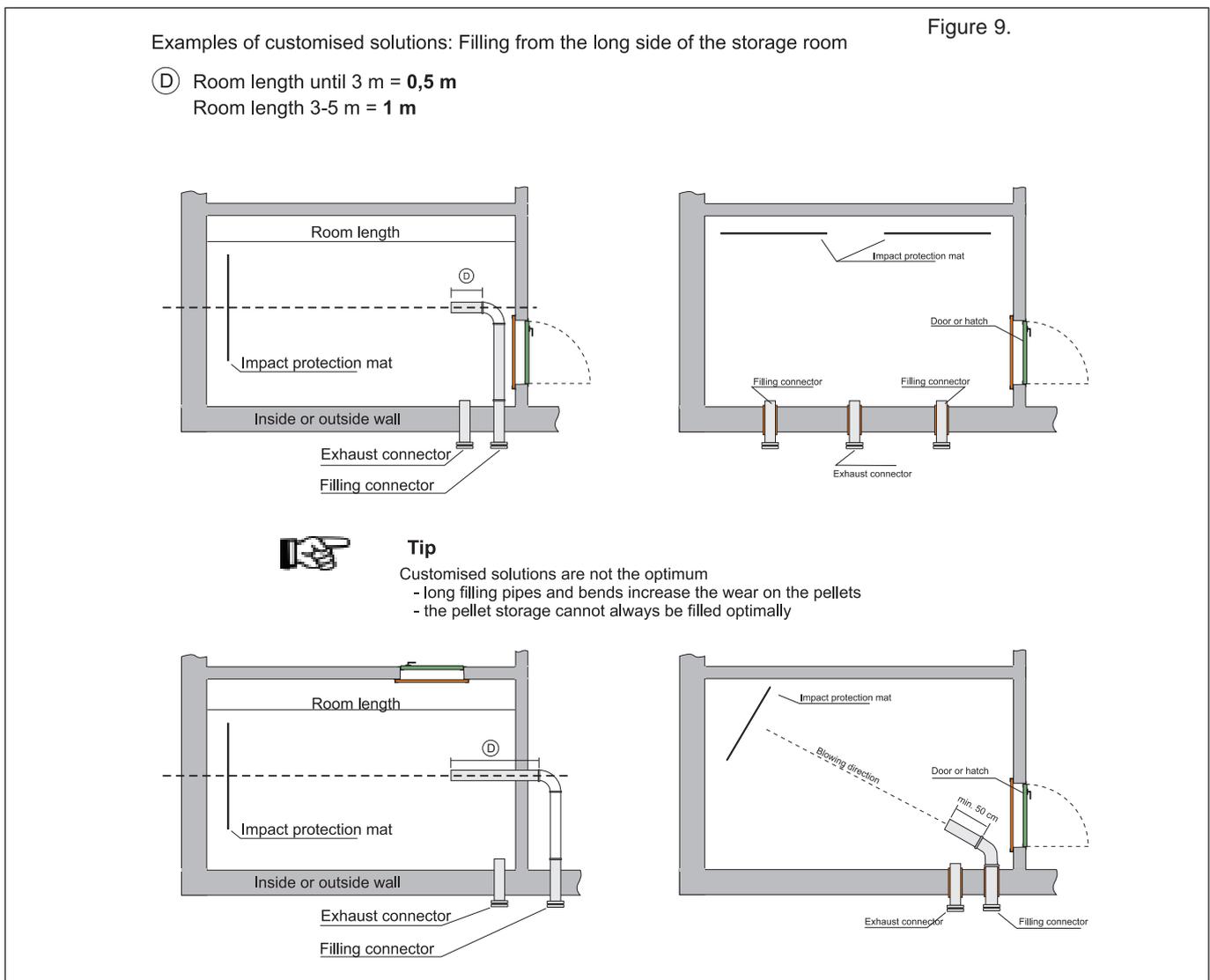
Customised filling system

If a standard solution cannot be used, a customised solution can be found in consultation with a competent firm (Figure 9).

Fire protection

Fire protection requirements for the storage room

Ensure that the local fire authority is consulted and that the building regulations are adhered to.



Checklist for the pellet storage room

○ Floor and walls

Are the floor and walls of the storage room dry?○ yes ○ no

○ Presence of installations

Are there lamps, switches, outlets or connection boxes etc. in the storage room?.....○ yes ○ no

Are installations that cannot be removed from the storage room (electrical cords, sewage lines etc), sufficiently protected with a deflection shield?.....○ yes ○ no

○ Filling pipe connector

Are end covers present?○ yes ○ no

Is there a safety sticker on the filling connection “Warning: switch off installation before filling”?.....○ yes ○ no

Is the filling connector pipe connected to earth?○ yes ○ no

○ House connection box

Is a house connection box present?○ yes ○ no

Has the door contact switch been tested?○ yes ○ no

○ Impact protection mat

Has the impact protection mat been installed and if so correctly?○ yes ○ no

○ Door to storage room

Is there a seal all the way around the door?○ yes ○ no

Is the key hole sealed from the inside?○ yes ○ no

Are protective boards applied on the inside of the door?○ yes ○ no

Is the storage room dust proof?○ yes ○ no

*For information and a free on-line advisory service on the wood energy supply chain,
the quality of wood fuels and internal handling visit www.woodenergy.ie*

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