Farm Structures
FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture and Food

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PLANNING SEED POTATO STORAGES

Most potato storage buildings in BC are of well-insulated wood frame construction. Cool outside air is used to control storage temperature. If the building is to be used as a refrigerated storage, rigid foam insulation should be used.

PLANNING

Seed potato storages should be flexible in bin numbers and sizes to match the growers production of various quantities of different varieties. Grading and handling of potatoes may be done within the storage structure in some designs or may be carried out in a separate building. Four sample layouts are shown to provide some basic alternatives to consider when planning seed potato storages.

The bulk seed potato storage should be sized based on a bulk density of 670 kg/m^3 (42 lb/cu.ft) with a maximum pile depth of 4.2-5.0 m (14–16 ft). The Canada Plan Service published by Agriculture Canada provides planning leaflets (330-00, 306-53) and sample building plans.

STRUCTURAL DETAIL

Heavy stud frame construction is required to withstand the pressures of deeply piled potatoes. Foundations are designed with an offset footing and extra reinforcing steel to hold the large outward wall pressure without tipping. By finishing the outside grade well above the floor, the footings are protected from frost heave and additional potato storage space is provided below grade.

Figure 1

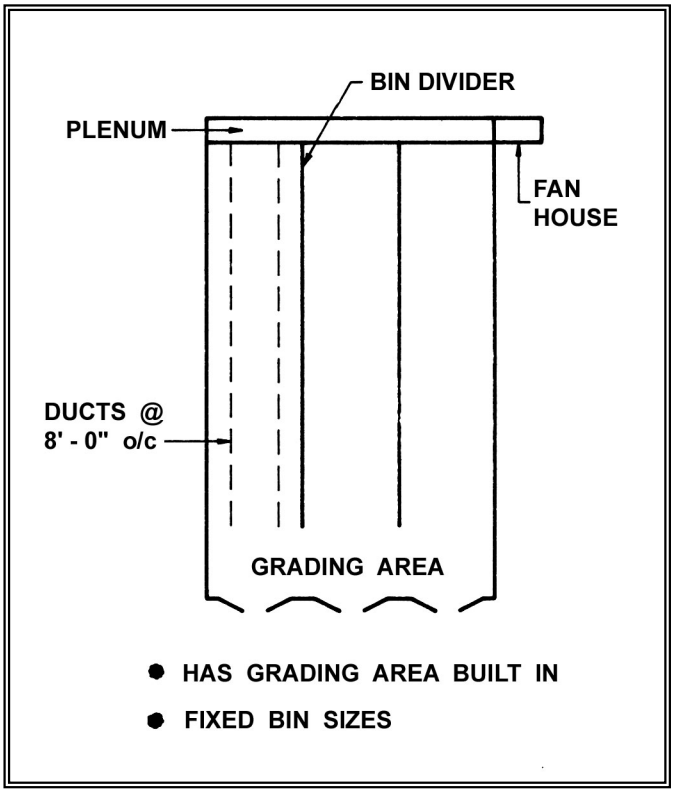
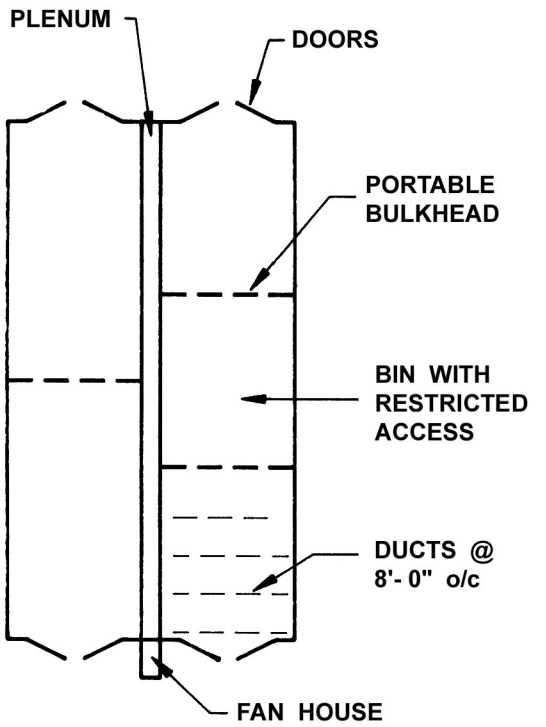


Figure 2



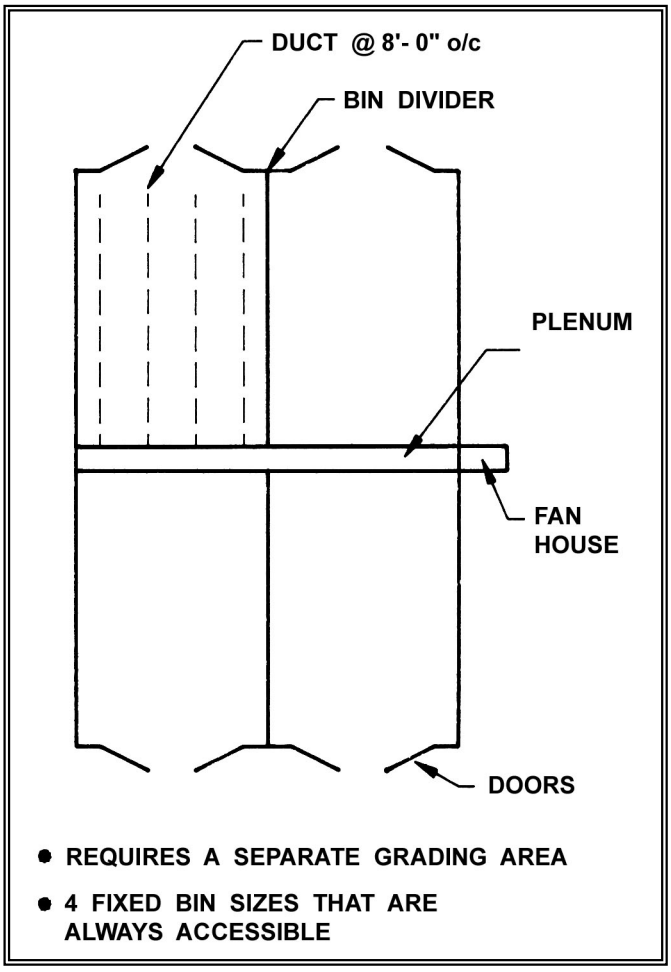
It is important to insulate the foundation to reduce condensation and prevent chilling of crop near the foundation. This insulation is most effective when applied to the outside. Use moisture-resistant extruded polystyrene foam board. It must be covered on the outside to protect against damage and sunlight. The best construction technique is to tack the rigid insulation to the inside face of the outside forms where it will bond to the fresh concrete when the foundation is cast. Finishing nails are best for this, as the small nail heads will simply pull out through the insulation board when the concrete forms are stripped.

Bulk produce exerts too great a pressure on the walls for ordinary anchor bolts. A specially designed wall anchor made from steel angle is recommended. This must be welded ahead of time and ready to place in the fresh concrete so be prepared before ordering foundation concrete.

Exterior walls and ceilings must be well insulated to maintain the recommended high humidity (90% +) storage. As a guideline, use at least the following suggested minimum insulation levels:

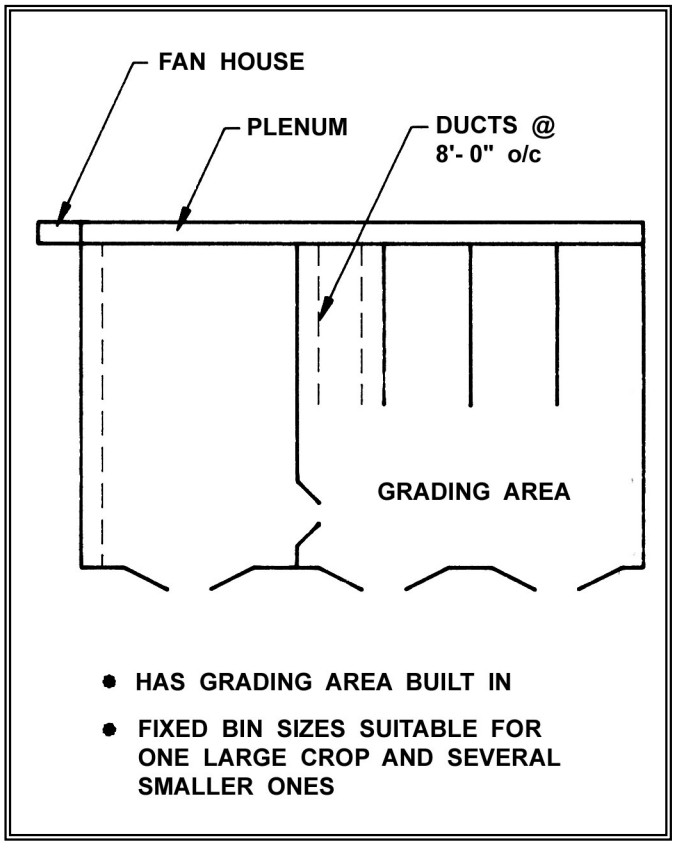
Outdoor design temperature °C	Insulation			
	Walls		Ceiling	
	RSI	(R)	RSI	(R)
-35	5.6	(32)	7.0	(40)
-30	5.3	(30)	5.6	(32)
-20	5.0	(28)	5.3	(30)
-10	4.2	(24)	5.0	(28)

Figure 3



These values are for storages lined on the interior with plywood. Storages that have steel interior liners will need more insulation to prevent storage problems resulting form excessive condensation. Consult Leaflet 306-53 for more information on insulation for vegetable storages.

Figure 4



When insulating with batt insulation, it is important that the batts fit snugly into the stud space, flat against the inside wall surface. Be sure there are no bulges or gaps in the insulation; these will allow cold air to touch or move along the wall surface. Wind-barrier building paper under the exterior steel siding is highly recommended. New wrapping papers, superior to traditonal felt paper are preferred.

A carefully sealed vapor barrier is required on the inside of the wall and ceiling insulation. As added protection against possible decay in critical areas, use CCA pressure-treated sills and plates and butt treat studs by dip soaking their ends in a compatible wood preservative such as copper napthanate (not penta or creosote).

The air plenum wall, located in the high humidity storage environment on one side and wetted by the humidifier on the inside, is particularly subject to wood decay. For greatest durability here, use wood studs pressure-treated with ACA or CCA preservative. Otherwise use Douglas-fir studs; they are more decay resistant than spruce and hemlock. Dip treat their butt ends. The treated studs are kept from direct contact with vegetables by plywood or steel sheathing.

Ventilation is improved and pile temperature kept more uniform by lining the exterior walls with boards (cedar preferred) spaced 40 mm out from the wall by vertical nailer strips.

Roof trusses must handle roof snow and dead load, **in addition to the outward pressure of the potato pile** on the walls. Be sure to increase the truss lower chords and connections to handle this extra force as specified on your building plan. A special folded steel strap anchor is used to attach each truss to the side wall plate.

The ceiling is an important structural component in a bulk storage. It ties the end walls to the building, holding the high wall pressure. The ceiling also braces an empty building to resist wind forces. Follow the ceiling construction details in the plan carefully.

Ceilings for vegetable storage may be either galvanized steel or plywood. The steel ceiling lasts longer but its shinier, less absorbent surface is slightly more subject to condensation than plywood. On the plywood ceiling, a dark-colored stain or paint provides better control of condensation and improves durability.

The air plenum and concrete floor should be designed as a complete drainage system for hosing out and disinfecting the storage. The concrete floor bears on top of the footings opposite the air plenum and slopes slightly towards it. The plenum floor is a little below the storage floor so wash water can drain through the air duct openings. In the plenum, install a pump that can be drained or pumped for disposal.

In addition to storage cleaning, high capacity humidification often produces excess moisture which drains out of the air plenum. It helps to have the far end of the building about 100 mm higher than the fan end but this requires more precise work in setting forms and footings to make the building “off-level”. Slope the floor, foundation and ceiling uniformly towards the fan end but keep all the studs and endwalls vertical. Sidewall claddings will show a little ‘off-square’ when fastening in place but this will disappear when trim and flashings are added.

VENTILATION AND HUMIDIFICATION

Modern, fully automatic ventilation systems are available to control temperature and circulate air through the potato pile. Air should be forced along the main air plenum outwards through the lateral ducts and up through the pile. It is a good idea to have a bypass valve through the floor at the end of the main plenum to provide partial recirculation of air to help control condensation in coldest weather.

Design an air handling and distribution system that adheres to sound engineering principles. The air flow rate should be 7.8 L/s.t (15 cfm/ton). This can be considered a minimum airflow required for refrigerated bulk storages. In cooler regions, a minimum of 6.2 L/s.t (12 cfm/ton) should be provided and in warmer regions without refrigeration up to 10.4 L/s.t (20 cfm/ton) may be required. Lateral ducts should be spaced at intervals of 2.4 m (8 ft) or two-thirds of the pile depth.

Temperature of ventilating air is controlled by two sets of proportioning dampers which blend cold outside air with return air from inside the storage. Commercial control systems are available for this application. It is important to understand the operation of the particular system chosen.

These systems usually consist of the following components:

(1) Ventilating fan to circulate the correct amount of air. Select fans to operate at a static pressure of 250-300 Pa (1.0 to 1.25 in., water gauge).

(2) Motorized dampers on fresh air and return air usually controlled by separate damper motors.

(3) Air plenum thermostat, a modulating type that controls the damper motors to provide the precise temperature desired.

(4) Low-limit “safety” thermostat in the air plenum to shut down the ventilation system if air temperature is too low for any reason.

(5) A differential thermostat that does not allow the system to operate when outside air is not cool enough to provide cooling. This control can also start and operate the ventilation system when outside air is cool enough (during the night, for example).

(6) A 24-hour clock for regulating operating time.

(7) A high capacity humidification system. Humidifier capacity should be about 30-40 L/(h.1000 tonne) or 7.5 gal/(h.1000 ton) of potatoes.

Building the fan house with fan and air blending controls on the end of the storage uses the storage space most efficiently. At the fan room, ventilation controls that use motorized dampers to blend ventilating air often have problems with freezing of fresh air dampers in cold weather. An effective method of minimizing this problem is to separate the cold-air dampers from the humid inside air by an insulated door which can be closed for cold weather. A smaller opening in this door, covered with a blanket or plywood, swings open for temperature control. This added feature is not required for locations where winter temperature is seldom colder than -20°C.

REFERENCES

Further information can be obtained from:

1) Canada Plan Service (CPS) plans.
2) Fruit and Vegetable Storage Insulation (Leaflet 306-53).
3) Ventilation Instruments (CPS 9703).
4) Wood preservatives (CPS 9401).
5) Insulation in Farm Buildings (Ag. Can. 1601/E).
6) Insulation and Vapor Barriers in Potato Storage Buildings (PNW 295).
7) Potato Storage and Quality Maintenance in the Pacific Northwest (PNW 257).

For further information on related topics, please visit our website

Resource Management Branch

www.agf.gov.bc.ca/resmgmt

Linking to our

Publications and Conceptual Plans

FOR FURTHER INFORMATION CONTACT

Bert van Dalfsen, Mechanization Engineer

Phone: (604) 556-3109

Email: Bert.vandalfsen@gems4.gov.bc.ca

RESOURCE MANAGEMENT BRANCH

Ministry of Agriculture and Food

1767 Angus Campbell Road

Abbotsford, BC CANADA V3G 2M3