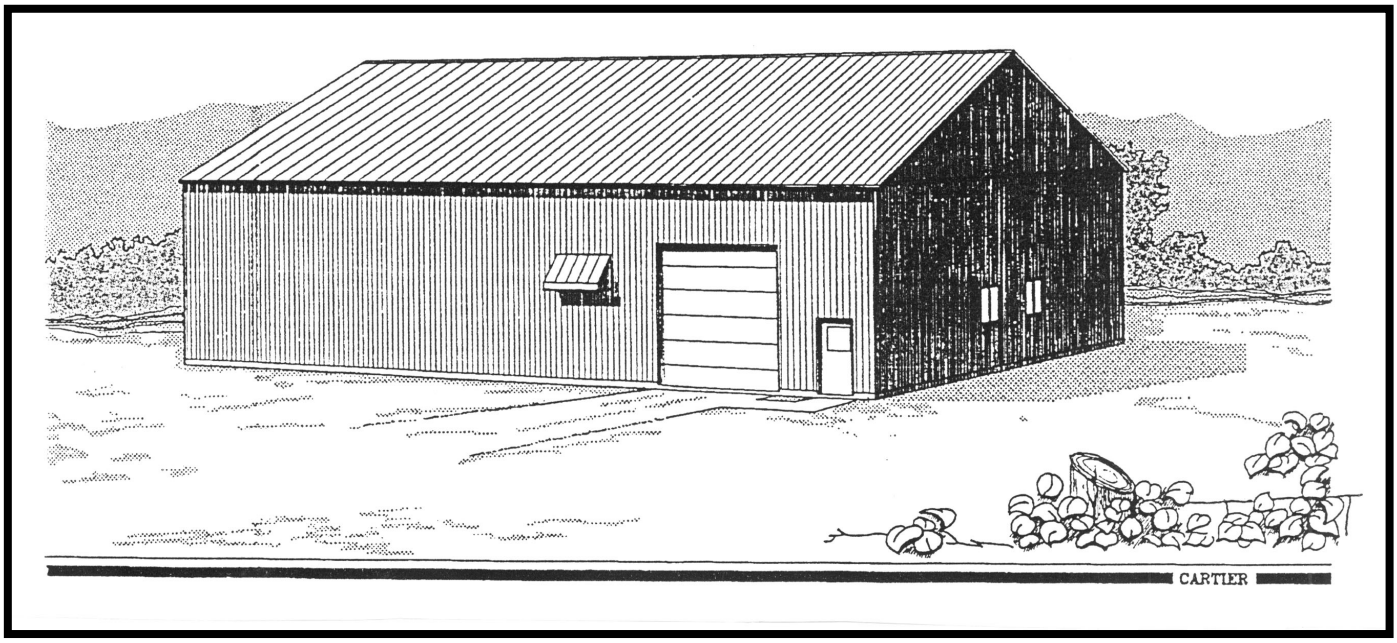
BRITISH COLUMBIA Ministry of Agriculture, Food and Fisheries
Agricultural Building Systems Handbook
PLAN
331-04

CONTROLLED ATMOSPHERE (CA) STORAGE



DEVELOPED BY CANADA PLAN SERVICE

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This plan set details the construction of a wood-frame, controlled atmosphere (CA) storage for fruits and vegetables.

The building is designed to store apples in pallet boxes measuring 1000 mm x 1200 mm x 75 mm high, containing 18 bushels.

The ceiling height allows for seven pallet boxes to be piled one atop the other, as in the large commercial CA storages. Each storage room has a capacity of 378 pallet boxes, each containing 18 bushels of apples, for a total of 6,804 bushels per room.

A sorting and packaging room adjoins the two storage rooms. Construction of the two (2) additional rooms provided in the plan can double the storage capacity to 27,200 bushels. The sorting, packaging and handling rooms would thus serve the four (4) storage rooms.

CONSTRUCTION FEATURES

The walls of the storage have studs 6000 mm long, making it possible to store seven pallet boxes one atop the other. Because lumber is not available in these lengths, planks of 4800 mm are recommended, combined with a 1200 mm extension piece. The two pieces are secured by a third 2400 mm plank nailed to the side.

The studs measure 38 mm x 184 mm and are spaced at 400 mm to withstand combined wind and snow loads while reducing warping. Excessive warping could damage the air seal of the storage rooms.

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The storage is insulated and sealed with polyurethane. It is recommended that 75 mm of polyurethane be sprayed from the inside. It is best to begin at the corners and wall/ceiling joints when applying urethane. For effective results, apply the insulation at a density of at least 32 kg per cubic metre (2 lbs./ft^3).

Next, apply a sealant to the polyurethane to prevent moisture from penetrating through the insulation. The sealant also improves the air seal.

Zonolite 3300 fireproofing is sprayed on the vapour barrier to obtain the required fire protection.

AIR SEAL

Airtightness is of major importance in CA storages, and special care must be taken, especially at wall/floor joints. Materials must have good elasticity because the floor sags a little when the storage is being filled.

Ensure that caulking can withstand temperatures of 0^0C without cracking. Also, give particular attention to the airtight door, electrical conduits and evaporator supports to obtain an excellent seal.

REFRIGERATION

Refrigeration capacity is 67,800 BTU or 71,529 kilojoules per hour. This allows for the storage of more than 30 pallet boxes per day so that the storage can be filled over a period of approximately 10 days. For higher filling rates, increase the refrigeration capacity.

To ensure high relative humidity in the storage, large surface evaporators are recommended. Evaporators should be chosen to meet refrigeration demand, with a ΔT (also called TD) equal to or less than 5^oC.

The evaporators must also be equipped with a defrosting system. Electric defrosting is more commonly used than hot gas defrosting.

CONTROL OF ATMOSHPHERE

Oxygen reduction is achieved using liquid nitrogen containers. Each 1,000 bushels requires 110 litres (see M.A.P.A.Q. factsheet 60400 for more details about this technique).

Carbon dioxide gas (CO_2) is controlled through a lime room. Each 1,000 bushels of apples requires 1,000 lbs of lime, some of which can be placed directly in the storage.

A water trap and expansion bag are excellent means of offsetting the barometric changes and pressure variations caused by the refrigeration system's evaporators during the defrosting process. The trap protects the building from excessive pressure, while the expansion bag reduces outdoor air exchanges.