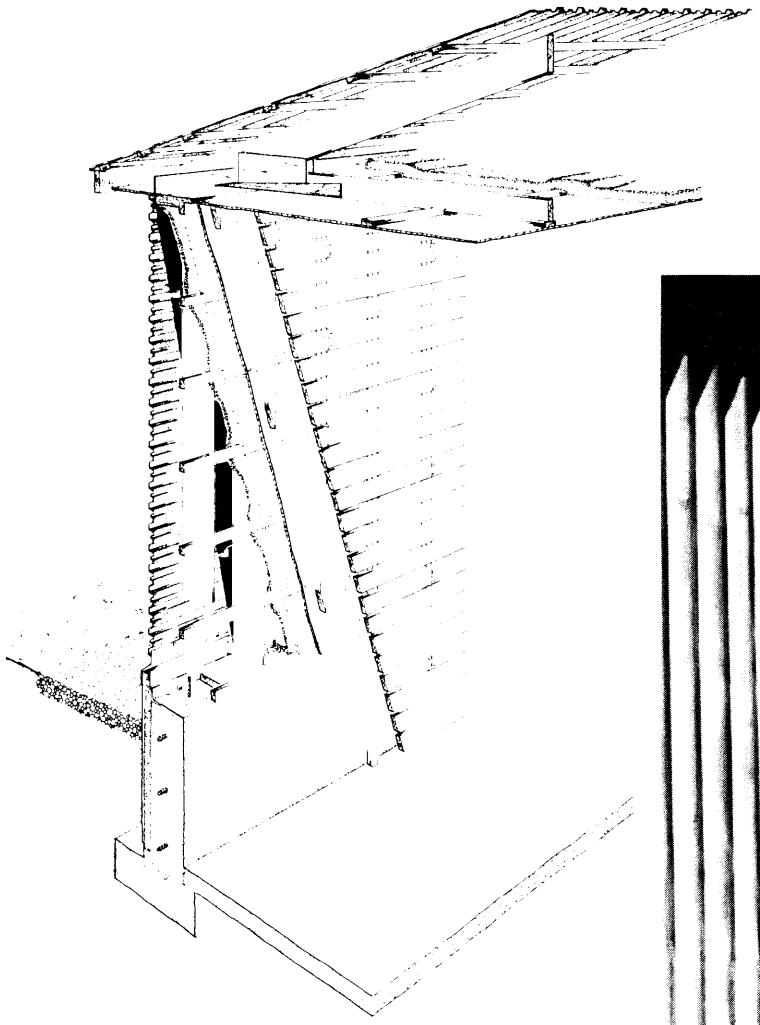
PLAN
M-6330

FRUIT AND VEGETABLE STORAGE INSULATION

COMPLETE INSTRUCTIONS



CANADA
PLAN SERVICE

The Canada Plan Service prepares detailed plans showing how to construct modern farm buildings, livestock housing systems, storages and equipment for Canadian agriculture.

To obtain another copy of this leaflet, contact your local provincial agricultural engineer or extension advisor.

TABLE 1 RECOMMENDED CEILING INSULATION RESISTANCE VALUES (RSI) FOR NON-REFRIGERATED STORAGES[1]

Outside design temperature (°C)	Crops requiring high-humidity storage (0-10°C, 90-95% RH)	Squash, Onions (70-75% RH)
- 15	2.9	2.6
- 20	3.9	3.0
- 25	4.8	3.5
- 30	5.8	4.0
- 35	6.8	4.4

1 Values have been selected to reduce ceiling condensation. Values for the walls may be reduced about 20°/ For rough, dark surfaces having good air speed over the surface, the tabulated values can be reduced by up to 25%.

TABLE 2 INSULATION RSI VALUES (RESISTANCE TO HEAT FLOW)[1]

Insulation material	Thickness (mm)	RSI value Per thickness shown
Mineral wool or glass fiber, blanket insulation (including paper-faced and friction fit) (24-64kg/m³)	25	0.65
	100	2.6
Macerated paper	100	2.5
Cellulose fiber (cotton, wood pulp, etc.)	100	2.5
Expanded mica, "vermiculite", (64-96 kg/ m3)	100	1.8
Straw (cut, dry)	100	1.0
Corkboard	100	2.5
Polystyrene foam		
Expanded headboard (16 kg/m³)	25	0.61
Extruded type (25-35 kg /m³)	25	0.69-0.87
Polyurethane foam,		
(applied at site)	25	1.04 [2]
(24-40 kg /m³)	50	2.08 [2]

1 From Agriculture Canada Publication 1601, Insulation in Farm Buildings, and other sources. Units for RSI are m²•°C/W To convert RSI to R (Imperial unit - hr•ft²•°F/BTU) multiply RSI by 5.7.

2 These are 'aged' values for sprayed-on foam and the values may continue to decline as urethane ages. Some manufacturers claim much higher RSI values due to gases other than air being trapped in the foam during the manufacturing process. Since in time air- tends to replace these gases, the claimed values cannot be maintained unless the faces are factory-sealed with a gas tight seal such as metal foil.

One practical way to protect plastic foam insulation is to use the "inside-out" construction described in the previous paragraph.

Rigid insulation board is usually applied continuously across the interior of the framing members whereas blanket, bast or loose fill types must be fitted between the members for support and protection. Loose fill insulations are not recommended for walls as settlement often leaves voids at the top of the stud spaces.

In buildings the insulation is not continuous around the framing members. During cold weather, condensation usually occurs at these cold spots (thermal bridges). Steel frame buildings in particular are prone to thermal bridging over purlins or beams, and require special construction techniques to minimize this problem.

One way to minimize the thermal bridging problem is to cover the inside of the wall studs or roof trusses with 38 mm (1'/2 in.) rigid foam insulation, then use less expensive batt insulation between the frames to build up the overall insulation value.

Wind can affect performance of batt insulation in walls. Place a wind barrier under the exterior sheathing. Wind barrier material must not be a vapour barrier. Breather-type building

paper can be used, but there are new specialized wind barrier papers which are much better.

An insulated concrete foundation is particularly important for vegetable storages to prevent freezing of produce, cold floors, excessive condensation or frost action below the footings. Insulation is most effective on the outside of the foundation. Extruded polystyrene foam is best attached by tacking it with finishing nails to the inside of the outer forms before the concrete is placed. For mild regions use 50 mm (2 in.) and for colder regions, 75 mm (3 in.). Protect the outside with cement asbestos board, or a plaster coating of latex cement or masonry cement. These plaster coatings are usually trowelled over expanded metal or wire lath.

Where soils are susceptible to frost heaving, wet soil can freeze to the foundation and then heave, rupturing the insulation or damaging the building. Take care in design and construction to ensure good drainage away from the building.

EXAMPLE: Calculate the insulation required for a potato storage at Alliston, Ontario, where the outside design temperature is - 23°C

from Table 1: RSI for ceilings 4.8

from Table 2: polyurethane for ceilings:

$$\frac{4.8 \times 25}{1.04} = 115 \text{ mm (use 125 mm) (5 in.)}$$

or glass fiber blanket insulation:

$$\frac{4.8 \times 25}{0.65} = 184 \text{ mm (use 200 mm) (8 in.)}$$

The insulation in the wall should be about 80% of that of the ceiling. Use 0.80 x 125 = 100 mm (4 in.) of polyurethane of at least 0.80 x 200 = 160 mm (6 in.) of glass fiber blanket insulation.