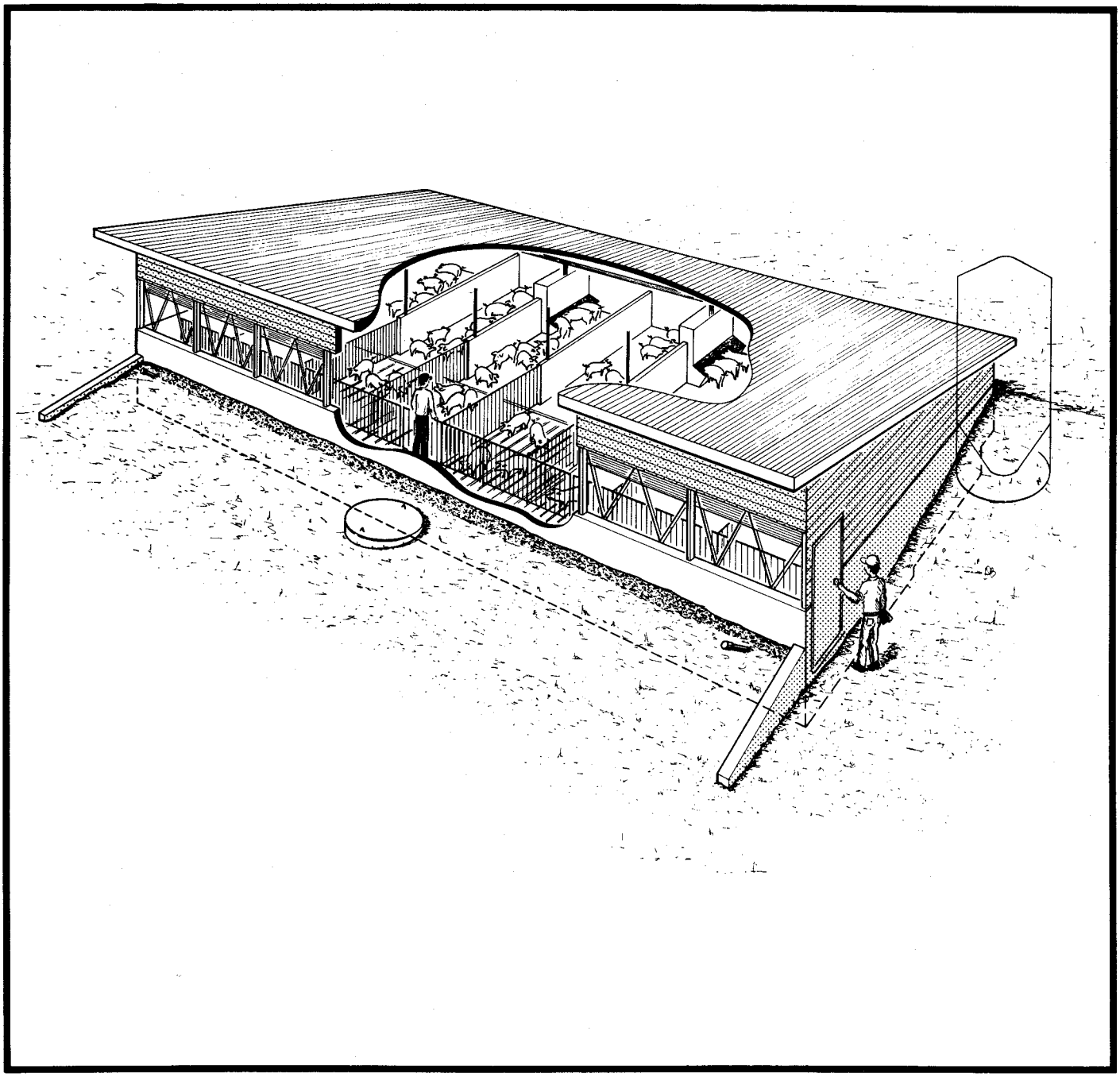
PLAN
M-3435

MODIFIED OPEN-FRONT GROWER-FINISHER



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.

This leaflet gives management information and describes one of these detailed plans. To obtain a copy of the Canada Plan Service detailed plan, contact your local provincial agricultural engineer or extension advisor.

MODIFIED OPEN-FRONT GROWER-FINISHER

Plan M-3435 NEW 84:07

This plan gives details for building a naturallyventilated swine barn designed primarily for growing and finishing pigs to market weight. With minor changes to feeding equipment and pig handling it could also serve for housing breeding sows or replacement gilts. The design is based on the popular Nebraska-type 'MOF' pig barn with some minor Canadian adaptations. It is most suitable for the milder parts of Canada such as southern Ontario, the Maritime Provinces and British Columbia.

The plan is for a barn 8.4 x 19.2 m, with a single row of pens along a front alley. The length can easily be adjusted in one-pen increments of 2.4 m. The design does not allow for variation of pen width. Each pen is 2.4 m x 7.0 m = 16.8m²: space for abou t40 growers to 60kg or 20 finishers up to 95 kg market weight. Rated capacity for the eight-pen unit as drawn would be about 260 pigs.

SITING This barn should face south or nearly south, and fits best into a slight hillside sloping south at about 8-10%. Extra earthmoving will be required if this ideal site is not available.

CONSTRUCTION The perimeter foundation is cast-in-place concrete, with a layer of rigid polystyrene foam insulation board fixed midway between the concrete forms. Contractors in Ontario have developed nifty little form-ties that penetrate between vertical slabs of the insulation board; these form-ties have extra spacer-tabs that are bent over to hold the insulation securely centered in place while the outside row of forms is lined up and the concrete is poured. A special splitter-box slides along the top of the formwork, dividing the flow of wet concrete into two equal halves so that the pressures from the concrete are equalized on both sides of the insulation board. The resulting foundation is warm, durable, maintenance-free and rodent-proof. Of the many different concreteinsulation sandwich walls tried over the years, this one is proving the most popular. In this case the insulated concrete is extended to about 1.2 m above the pen floors, and completely eliminates the problem of pigs chewing the woodwork.

Above the foundation, the endwalls are insulated stud frame. The front and rear walls consist of laminated plank posts spaced at 2.4 m intervals and anchored to the foundation. A special bolted steel anchor at the short rear wall posts provides all the necessary. swaybracing for the building; this eliminates the exposed knee-bracing used inside previous designs and reduces the places where troublesome dust and dirt can accumulate.

The roof structure is supported at midspan on steel or wood columns set into the concrete pen partitions at 2.4 m spacing. These in turn support continuouslaminated plank rafter beams which follow the 1:5 low-slope roof. Roof purlins (on edge) easily span the 2.4 m rafter beam spacing, support the ceiling and roofing, and provide space for insulation between ceiling and roofing. Unlike conventional beam-and-rafter construction, this system provides a smooth sloping ceiling without any obstruction to the natural air flow essential to the ventilation of the unit.

INSULATION Natural ventilation requires at least as much insulation as fan-powered ventilation. The roof construction described above can be adjusted to suit the severity of the winter climate and the type of roof insulation used. Roof purlins 38 x 140 mm provide just enough space for RSI-2.5 friction-fit fiberglass insulation about 100 mm deep, plus a little essential ventilated air space between insulation and roofing. In colder climates, increasing to 38 x 184 mm roof purlins and RSI-3.5 insulation (about 135 mm deep) is advised. Another alternative is to start with about 25 mm of foamed-in-place polyurethane, sprayed from above between the purlins onto the upper surface of a steel or plywood ceiling. This is followed by lessexpensive fiberglass insulation, then the roofing. The foam insulation seals and bonds the ceiling better than the conventional polyethylene vapor barrier, and reduces the total insulation depth required. Do not apply the foam insulation to the underside of the ceiling where it would be exposed inside the barn (moisture problems, and fire hazard!).

The low 1:5 roof slope is flatter than usually recommended for steel roofing, but is essential to the overall building design. Silicone caulking is recommended between all steel roofing side-laps (and end-laps, if used). Immediately after caulking the side-laps, they should be tightened with stitch-screws power-driven midway between purlins: Consult your roofing supplier for other special instructions and suitable roofingprofiles for this low slope.

NATURAL VENTILATION This is the design that started it all. The natural buoyancy of air warmed by the pigs provides the primary energy to move air in and out of the building, supplemented by wind to move the greatly increased air supply required in summer.

Figure 2 shows how the ventilation should work in cold weather. Pigs resting at the more-comfortable back end of the pens produce heat and moisture, giving a gently-rising flow to the air mass above. This air flow meets the warm ceiling, turns forward and continues to slide up along the smooth ceiling until it meets the front wall where a. small part of the air flows out through the outlet slot. But most of this flow cools slightly, settles towards the alley and returns to the back along the surface of the slotted floor.

An innovative feature of this design is an upside-down 'plastic curtain' (details in Plan M-9351) that provides an adjustable air inlet slot, just above the south foundation. This slot allows some cold fresh air to be drawn into the barn, joining the cooled recirculating flow coming down the inside of the front wall, and replacing an equal small amount of air that went out at the top. The plastic curtain is a translucent, woven

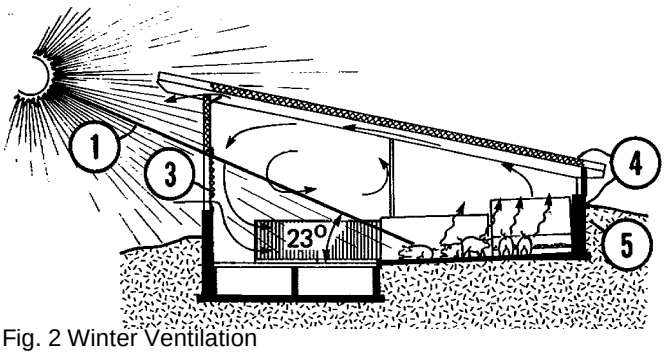


Fig. 2 Winter Ventilation

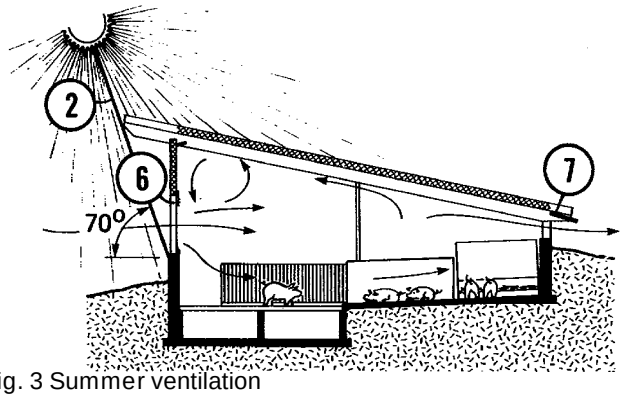


Fig. 3 Summer ventilation

1 noon winter sun, Waterloo, Ontario (43.5° N. Lat.) Dec. 21
2 noon summer sun, Waterloo, Ontario (43.5° N. Lat.) June 21
3 plastic curtain almost closed to foundation
4 foundation walls & ceilings well insulated
5 earth banked up to conserve heat
6 plastic curtain adjusted for wind and temperature
7 wall flaps open in hot weather

reinforced plastic sheeting that can be winched up or down each day in a few seconds, to adjust for outside weather changes. In this case the spaced hoistingcables are threaded in-and-out through small brass grommets riveted through the plastic; this forces the plastic to fold into regular zig-zag pleats, without bunching. A galvanized, straight steel rod (or electrical conduit) is slipped through a hem sewn into the bottom of the curtain. This secures the bottom ends of the lifting cables and holds the hem down and straight. Other previous inlet designs (including pivoting doors) were much more expensive to build and cumbersome to adjust. As a precaution against freezing the bottom of the curtain to the sill, it is suggested that the curtain should never be closed tightly at the bottom.

In longer buildings of this type, it is suggested that all flap and curtain controls be lag-bolted onto on the mid-length front post, and that the inlet curtains, outlet flaps and their control cables be split into east and west halves. This is in case a 'quartering wind' (from northwest or north-east) creates different pressures along the front slots. The outlet slot at the top of the front wall is most critical - it should be set so that it allows enough air to go out, but should almost never allow significant gusts to enter. Watch for puffs of vapor or snow coming in here, indicating unwanted inflow.

In principle, this winter ventilation arrangement makes a cooler area in the front of the pens and a cosy, more comfortable area at the back. This encourages active pig functions such as drinking and socializing on the front slotted floor, and a clean dry sleeping area at the back.

In summer the front curtain can be opened according to outdoor temperature and wind conditions. Observe the pigs carefully and adjust accordingly. In hot weather, wall flaps at the back of the pens can be unlatched and hooked open to allow maximum straight-through ventilation.

In both winter and summer, the front curtain admits abundant natural sunlight, but especially in winter when the sun is closer to the horizon (see Figures 2 and 3).

MANURE REMOVAL The ventilating front wall and hethin front curtain are often dripping with condensation and dirt. This is why the slotted floor is extended to include the front passage as well as the pens. Another reason, of course; is to eliminate one extra concrete curb wall to be formed and placed.

Trenches under the slotted floor grids are made as shallow as practical, to minimize in-barn manure storage time, and to reduce the gases and odors that stored manure produces. A stop-and-flow plug valve system is used, to completely stop leakage of liquid manure until enough liquid 'head' builds up to give a good flush. It is suggested that plug valves in the front and rear trenches be opened alternately; this gives an alternating flow through a cross-over opening connecting the 'dead ends' of the two side-by-side trenches. A further feature is a pumpout pipe at each end of the trenches; this allows a vacuum tanker to be connected up for back-flushing and pumping out sludge that may accumulate at the 'dead ends' of the trenches. This latter is especially recommended when barley is the principal ration ingredient, rather than corn.

Other types of manure removal may be used, such as the 'continuous-flow lip system' or one of the pumpflushed systems described elsewhere. However, the stop-and-flow valve system shown in this plan is the simplest seen to date. The round-bottom concrete plug valve is self-centering in case it gets popped out, and the plastic pipe saddle-tee connection is a neater way to connect the plastic riser-pipe valve to the main sewer below.

A gas trap outside the wall prevents manure storage gases from coming back into the barn, and a gravity sewer pipe (usually 200 or 250 mm PVC pipe) carries each flush of manure to remote, long-term storage. Trickling flow should be avoided at all costs because of possible freeze-up. Long-term storage big enough to handle at least 6 months' production (and better, 9 months') allows you to avoid spreading manure in winter on frozen and snow-covered ground (polluted spring runoff!), or in summer on growing crops.