PLAN
M-9324

INSULATED STUD FRAME WALLS

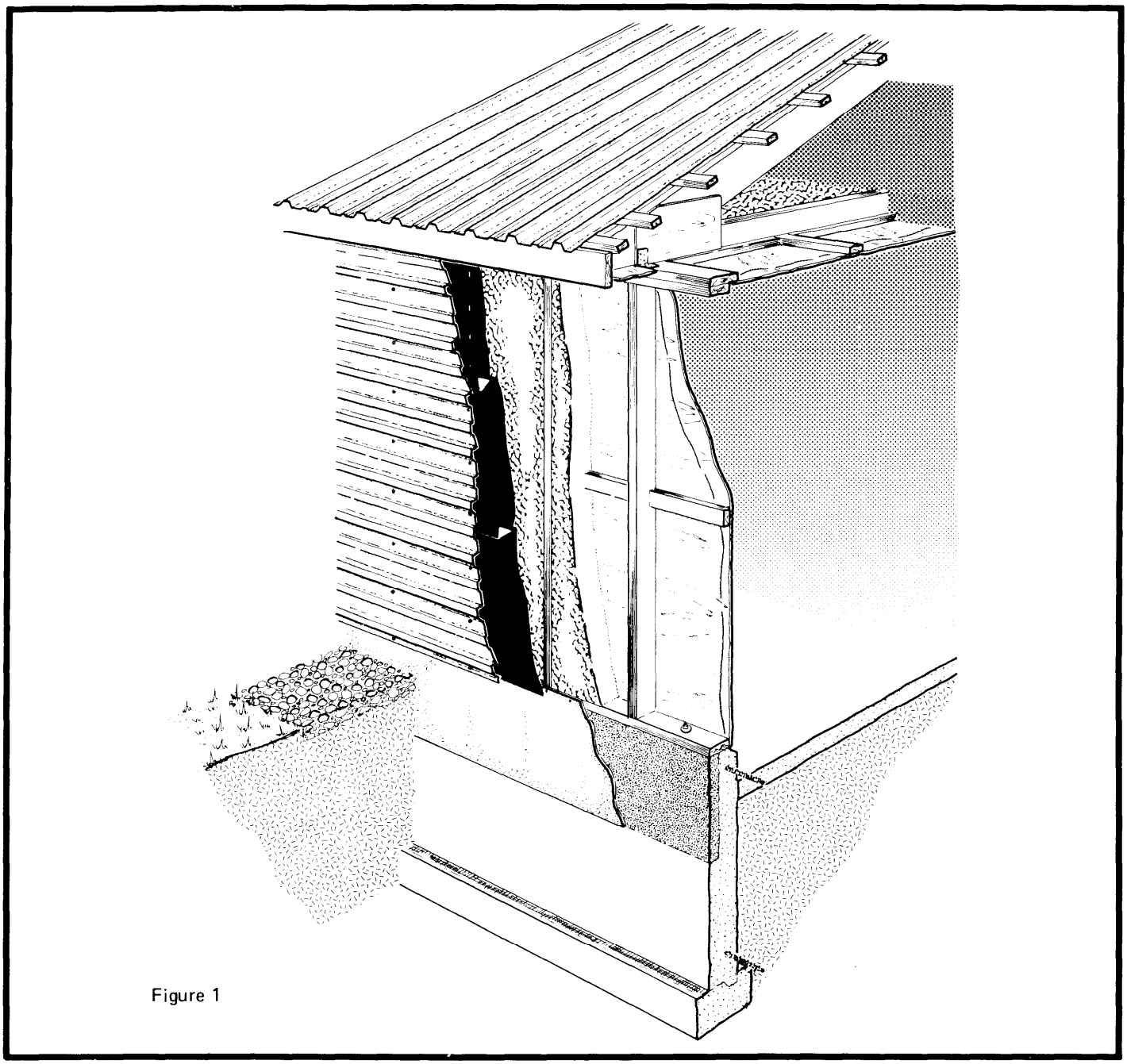

Figure 1

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.

INSULATED STUD FRAME WALLS

PLAN M-9324 REV. 81:1

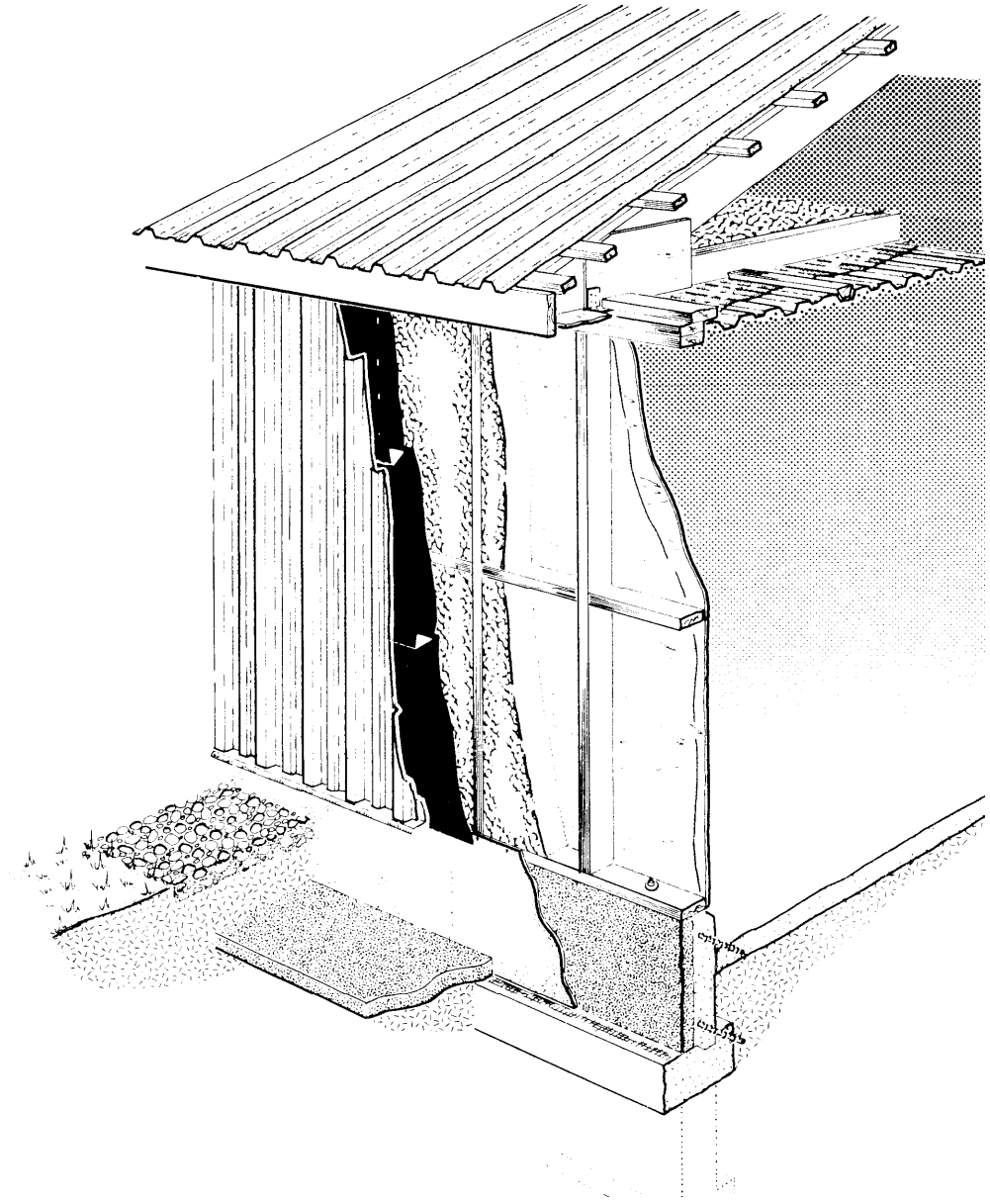

Figure 2

This plan gives details for building foundations and walls for insulated farm buildings. The plan is intended primarily for single-storey livestock or storage buildings which will be *continuously heated* in winter.

INSULATED CONCRETE FOUNDATION Foundation perimeter insulation is an essential part of this design; it conserves expensive heat which would otherwise leak out of the building in winter, and it helps prevent destructive frost from penetrating under the footing. The recommended insulation is extruded polystyrene foam board (Dow SM (blue) or equal), placed in the *exterior* side of the foundation concrete. This is important; insulation on the outside keeps the foundation warmer in winter, minimizes concrete cracking due to extreme changes of temperature, and helps prevent frost penetration under the footing.

The plan shows 50 mm thick polystyrene insulation for ordinary situations, or 75 mm for more critical applications such as poultry or pig brooding where temperatures will be higher (20°C or greater), or where winter temperatures are more severe.

Some contractors glue the perimeter insulation to the foundation. However, an easier and better way is to tack the insulation board to the inside face of the outside concrete formwork with *finishing nails*. When the foundation concrete is vibrated into place, it hardens and bonds with the pores in the face of the insulation board. This attaches the insulation much more securely than gluing, and it guarantees a perfect "fit", without voids between the insulation and the concrete. When the forms are stripped off later, the small nail-heads simply pull through the insulation board.

Exterior insulation must be covered with a hard material to prevent rodent damage and weathering. High-density re-compressed asbestos-cement board is the best choice; softer grades of asbestos board are not durable outdoors. Cut the sheets 50 mm wider than the insulation so that they extend up far enough to be drilled and nailed to the outside edge of the pressure-treated wood sill. Then either lap and nail the exterior steel siding over the top of the asbestos-cement board, or cover the edge with a galvanized steel flashing, folded to fit. Be sure that all corners, cracks and openings are tightly flashed with galvanized steel to keep out rodents.

PREVENTING FROST HEAVE The traditional way to prevent frost heave and cracking due to water and soil freezing beneath the footings is to place the footings below the depth of frost penetration (see Figure 1). In colder parts of Canada this means a very deep footing, which requires a lot of concrete and costly formwork. Around buildings kept heated throughout the winter, frost penetration is much reduced by the heat flowing outwards from the warm floor. And where exterior perimeter insulation is added, soil seldom freezes below the bottom edge of the insulation since the whole foundation is kept warmer by the insulation. This plan shows an optional shallow footing only 500 mm below grade (see Figure 2). For very cold regions such as the Canadian prairies, Northern Ontario and Northern Quebec, additional insulation is extended horizontally, just above the footing. This must be supported flat, on compacted sand. This exterior horizontal insulation is cheaper than a deep footing, is just as effective at preventing frost heave, and further reduces perimeter heat losses.

Do not use the shallow footing if the building may be left unheated during winter, or if deeper walls are required for manure tanks etc. below ground.

INSULATED STUD WALL Start the wood-frame walls with a pressure-treated wood sill, bolted securely to the concrete. The small extra cost of treated wood at this critical location can extend the life of the whole structure by many years, especially in areas frequently wetted, such as milking parlors, milk rooms and swine farrowing areas.

With vertical studs at 600 mm on center, exterior siding can be roofing steel, applied horizontally over asphalt felt wind-proofing and screwed directly to the studs. For a weather-tight and better-looking wall, use special-purpose roofing screws driven into the 'flats' between the ribs.

Horizontal wood strapping may be added to support vertical metal siding if preferred, but this has no structural advantages. Another choice is to screw vertical steel to the bottom sill, mid-height blocking and top plate as shown in Figure 2, in this case use the more rigid diamond-rib siding profile and space the blocking at not over 1200 mm. In all cases be sure that metal flashings are designed and *carefully fitted* to keep rodents out of the wall space.

Insulate the wall with 140 mm friction-fit glass fiber insulation (RSI-3.5) between studs, seal inside the studs with polyethylene vapor barrier, and nail on interior cladding. For this, exterior-grade softwood plywood is the most popular choice. Plywood is much stiffer when applied with face grain across the studs (horizontal); this requires wood blocking fitted between the studs at midheight, to support the joint between bottom and top courses of plywood.

The wall height specified on this plan is set to use 1200 x 2400 mm sheets of plywood without cutting. Note that the double wall plate at the top consists of one member 140 mm wide to match the studs, and another member 50 mm wider. This gives a 'shelf' for nailing the ceiling plywood securely to the wall. Proper nailing all around each sheet of ceiling and wall cladding makes the building into a rigid box to resist wind storms. This detail can be altered to suit a corrugated steel ceiling (see Figure 1, and plans M-9371 or M-9372).

INTERIOR WALL PROTECTION Pigs and calves can chew through plywood walls rather quickly. For walls in animal pens, add a layer of high-density recompressed cement asbestos board (Johns-Manville 'Flexboard', or equal). Softer grades are more brittle and will disintegrate quickly. When supported from behind with 9.5 mm plywood applied with face grain perpendicular to studs, asbestos board about 5 mm thick is adequate for most applications. In milk rooms and similar locations where a sanitary finish is more important than resistance to chewing, prefinished sheet materials such as prepainted galvanized steel, fiberglass-reinforced polyester plastic or high-density polyethylene may be substituted. For easier sanitation, seal between the edges and at the bottom curb with a high-grade synthetic caulking compound (such as GE Silicone rubber sealant).