MWPS-81902

20-Sow Solar Farrowing House

CAUTION!

Additional professional services will be required to tailor this plan to your situation, including but not limited to: assurance of compliance with codes and regulations; review of specifications for materials and equipment; supervision of site selection, bid letting and construction; and provision for utilities, waste management, roads or other access. **Furthermore, any deviation from the given specifications may result in structural failure, property damage, and personal injury including loss of life.**

WARRANTY DISCLAIMER

This plan provides conceptual information only. **Neither midwest plan service nor any of the cooperating land-grant universities, or their respective agents or employees, have made, and do not hereby make, any representation, warranty or covenant with respect to the specifications in this plan.** Additional professional services will be required to tailor this plan to your situation, including but not limited to: assurance of compliance with codes and regulations; review of specifications for materials and equipment; supervision of site selection, bid letting and construction; and provision for utilities, waste management, roads or other access.

MIDWEST PLAN SERVICE
Cooperative Extension Work in Agriculture and Home Economics and Agricultural Experiment Stations of North Central Region - USDA Cooperating
20-Sow Solar Farrowing House
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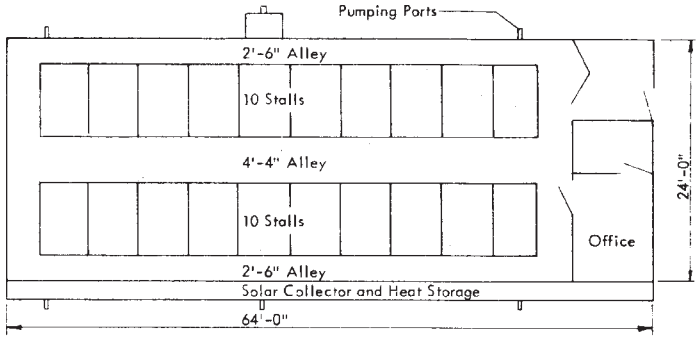
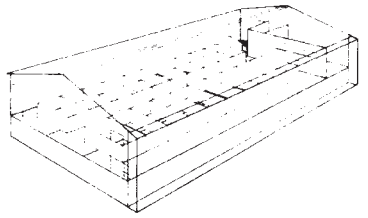


GENERAL FLOOR PLAN—1/1



SOLAR FARROWING HOUSE—2/1

Solar Heated Farrowing House

Farrowing Stalls on Slotted Floors

This plan is for a 24' x 64' stud-frame building for 20 sows in farrowing stalls. (If stalls are longer than 7 ft, increase building width to 26'-0".) Year-round forced ventilation (exhaust type) and liquid manure storage are provided. Winter ventilating air is preheated as it passes through gaps in a solar heated wall of solid concrete blocks along the south side of the building. The same wall can be used to cool ventilating air in the summer.

This plan is an adaptation from plan MWPS-72680.

General Specifications

Fans: Select exhaust fans for the stated capacity at ⅛" static pressure. The exhaust chimney reduces wind pressure against the fans.

Pits: Use 3500 psi concrete with 7% air entrainment. Use steel of at least 40,000 psi yield. Install steel and concrete carefully and accurately.

Set one 8" diam. PVC pumping port to serve as an emergency overflow from the pit. Place the tip of the plastic pipe low enough that an air space is always left between the surface of the manure and the concrete beams. Discharge any overflow to an approved facility. Pump from pit often enough to prevent overflow.

Pump pit to within 6" of the bottom at least once a year. Check for solids buildup; increase agitation and pump from port nearest to solids buildup at next pumping.

Pit depth is based on 0.54 cu ft/day manure per stall, 6" in pit after pumping, 12" freeboard, and 6" additional clearance to improve underfloor ventilation.

Heat: Desired room air temperature is about 72°F. The solar heating system provides a large portion of the energy needed to maintain this temperature. Build 15 to 20 sq ft of solar wall surface area per farrowing stall. However, a backup heater is still essential. Provide a 30,000 Btu space heater (1500 Btu/stall), or:

- If heated floor mats are used on the slats, provide about 150 watts (500 Btu) per stall floor heat, plus about 250 watts (900 Btu) per stall with overhead heat lamps or radiant heaters for use during farrowing.
- If no floor heat is used, provide overhead heat of about 600 watts (2000 Btu) per stall.

Protect Swine from Fan Failure

The exhaust chimney improves natural ventilation, but we know of no device that successfully ventilates a hog house automatically if one or more fans or the electric supply system fails.

- Install a loud automatic warning system to alert anyone at or near the farmstead.
- Have someone baby-sit your animals if you are going to be away for more than a few hours, if there are storm warnings out, or if your herd is in an especially sensitive stage (a number of newborn litters, for example).
- Post instructions on what to do in hot weather, mild weather, cold weather, who to phone for additional advice, etc.
- Prepare walk doors to be propped open.
- Consider a stand-by generator to augment hand-opened doors; operate pit fans and, in hot weather, circulating fans.
- Consider an automatic telephone that dials selected numbers when power fails.

Slat Design

Dimensions in this plan assume concrete slats as listed below and may need to be adjusted for other designs or materials. About ½" is allowed at each end of a slat for construction variation and grouting.

Space slats 3½" apart in farrowing stalls, with the slot widened to 1" behind the sows.

Slat span	Farrowing house, sow-pig nursery, or gestation
	Width x depth, lower bar size
4'	4"x4", #3
6'	4"x4½", #4
8'	6"x5", #5
10'	6"x6½", #5

Design Loads		
Slats	Per foot of slat	150 plf
Beams, columns	Per sq ft floor area	65 psf

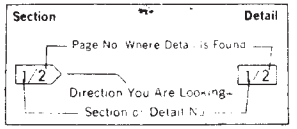
LUMBER SPECIFICATIONS

Roof Purlins and Studs
Construction Grade (Doug Fir, Southern Pine or Hem Fir)
Trusses
See Truss Page
Plywood
Roof Sheathing—3/8" c-c Ext ("Identification Index" = 20/0)
Siding and Wall Lining and Ceiling—3/8" or ½" c-c Ext with Medium Density Overlay

FRP Plywood is a composite material using plywood overlaid with a layer of plastic. It is moisture resistant and more durable and easier to clean than plywood.

Sills and Fascia
Pressure Preservative Treated (Southern Yellow Pine or equivalent) Creosote—8 pcf. Penta—0.40 pcf. ACC—0.25 pcf. ACA or CCA (Type A or B)—0.23 pcf.

P. T. means lumber pressure preservative treated against insect and fungus attack.



Section & Detail Indicator

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Cooperative Extension & Research in Agriculture & Home Economics in the 12 North Central Universities—USDA Cooperating

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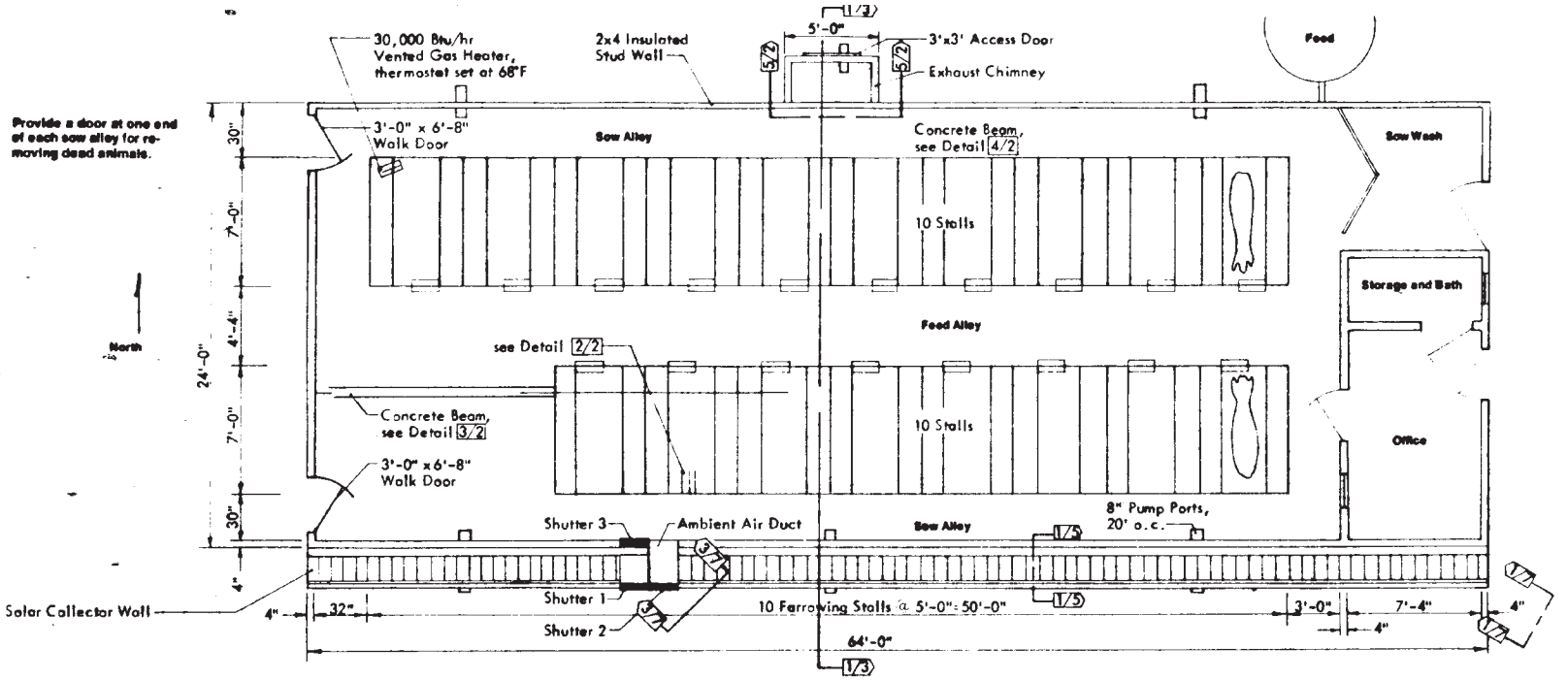
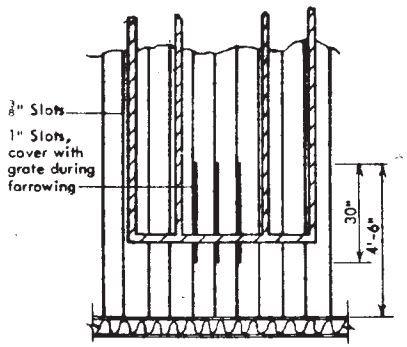
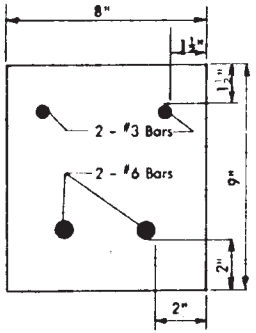


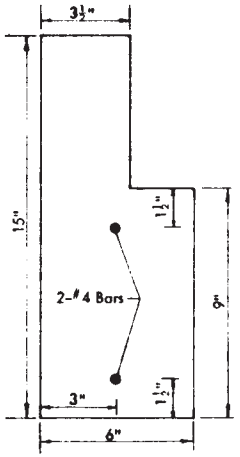
FLOOR PLAN—1/2



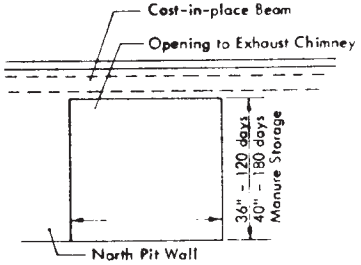
SLOT DETAIL—2/2



BEAM DETAIL—3/2



BEAM DETAIL—4/2



SECTION—5/2

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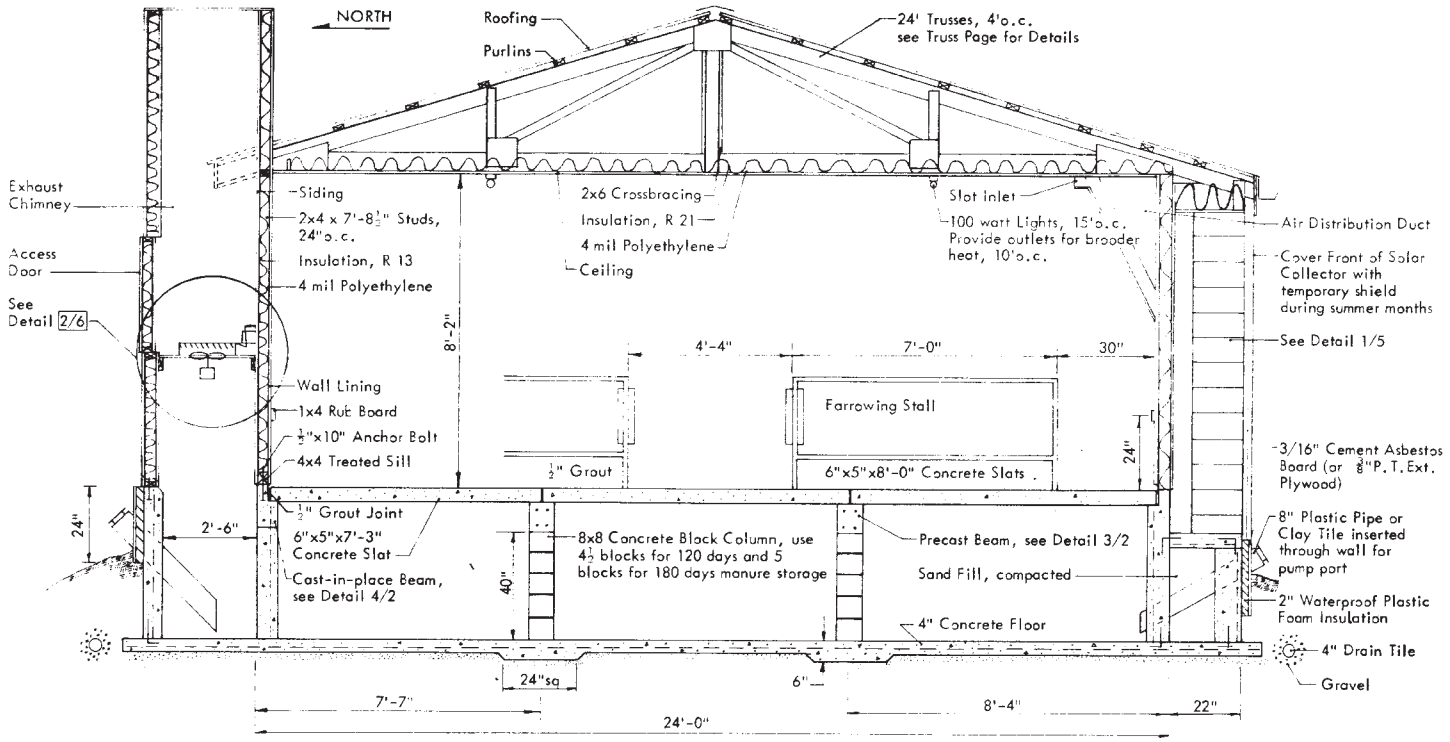
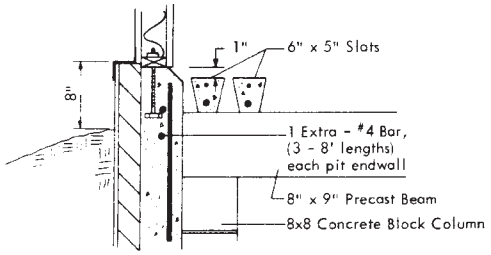
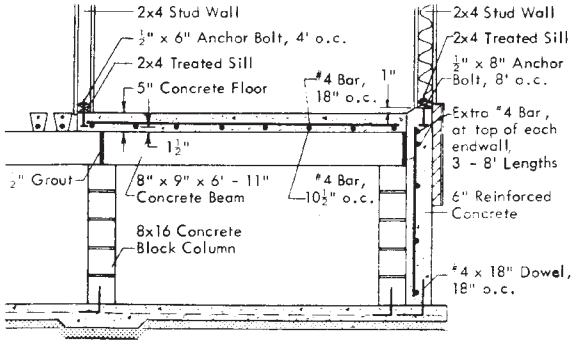


CROSS SECTION—1/3



PIT ENDWALL DETAIL—2/3



OFFICE FLOOR DETAIL—3/3

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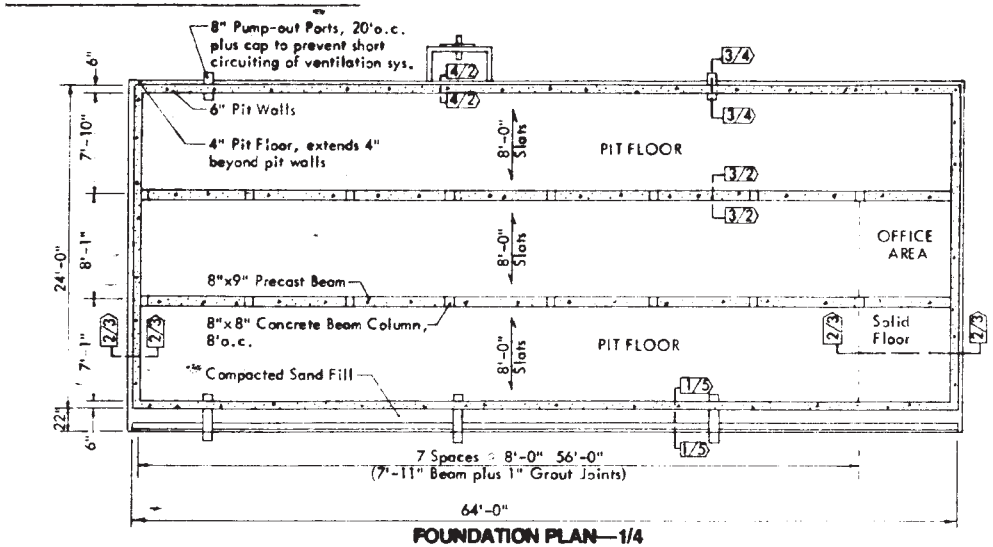
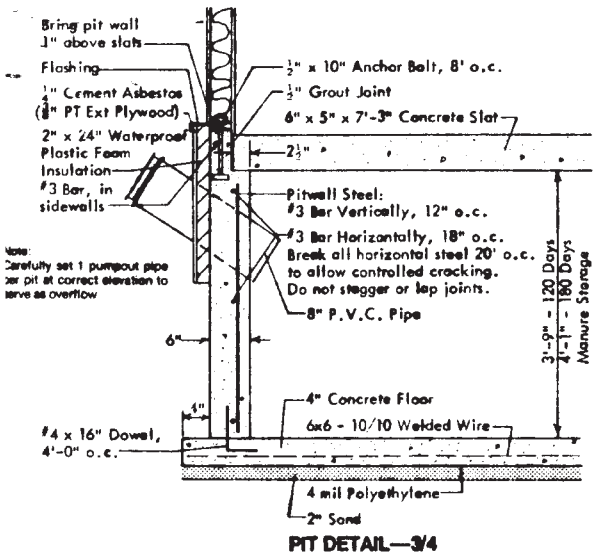
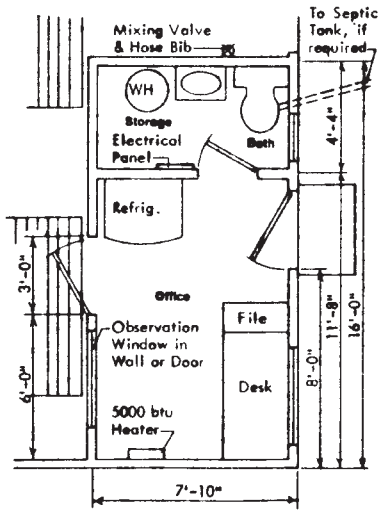


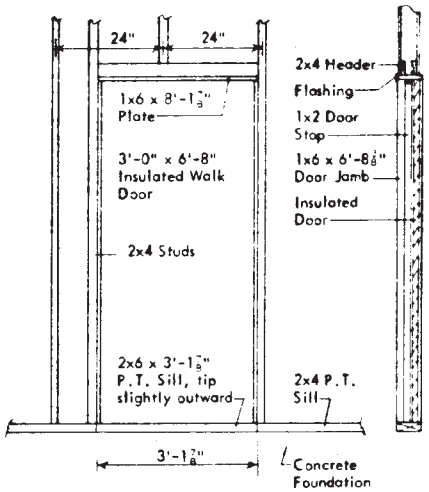
FOUNDATION PLAN—1/4

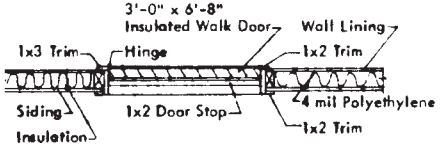


PIT DETAIL—3/4

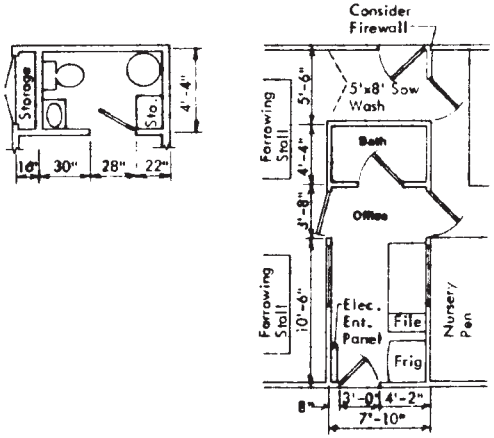


OFFICE LAYOUT—4/4





WALK DOOR DETAIL—3/4



OPTIONAL LAYOUTS

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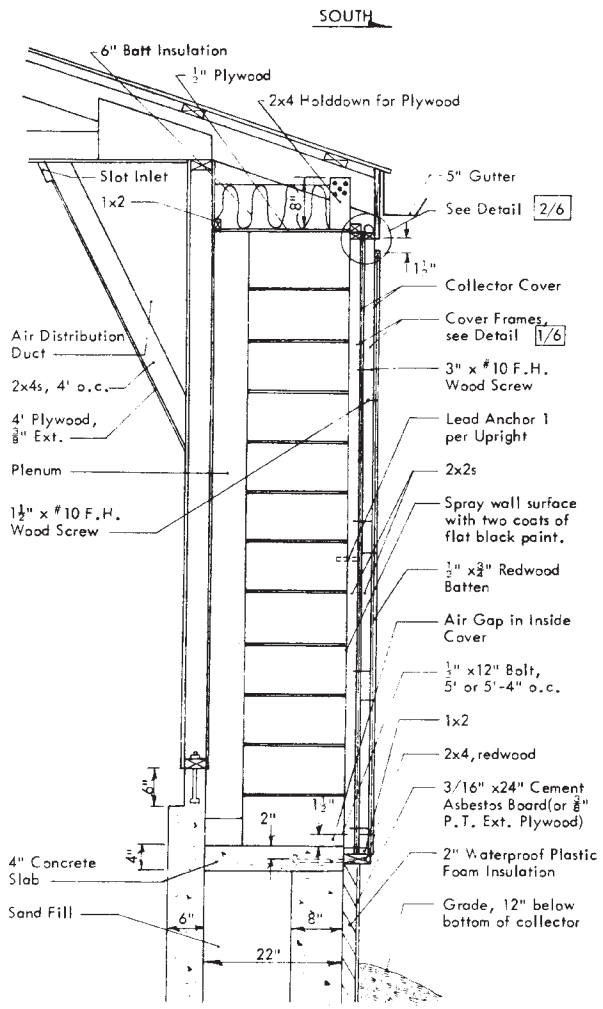
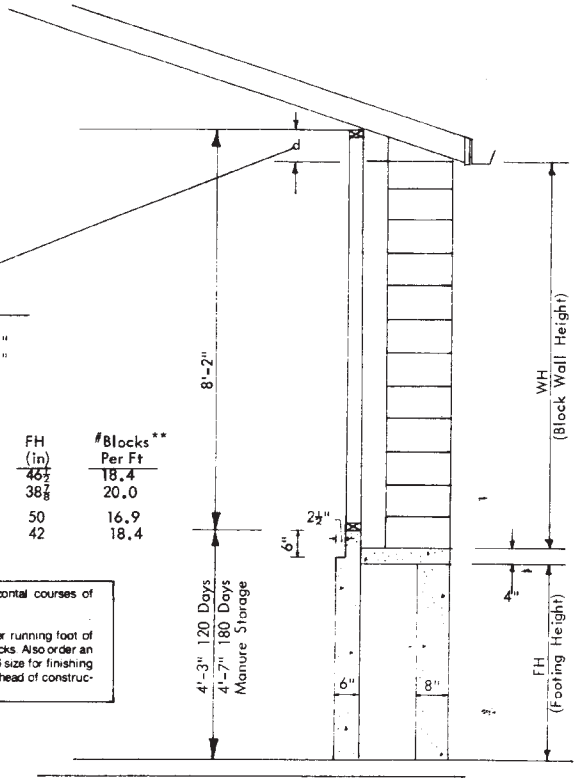


SOLAR WALL CONSTRUCTION DETAIL—1/5



	Rows of Blocks	WH (in)	FH (in)	#Blocks** Per Ft
Without Mortar	12	91½	46½	18.4
	13	98⅜	38⅞	20.0
With* Mortar	11	88	50	16.9
	12	96	42	18.4

*Standard ⅜" of mortar between horizontal courses of blocks.

**Calculated number of 8x8x16 blocks per running foot of wall with a 3/16" vertical gap between blocks. Also order an additional 4% more blocks of the 4x8x16 size for finishing ends and openings. Order blocks well ahead of construction because they may be hard to obtain.

BLOCK WALL SCHEMATIC—2/5

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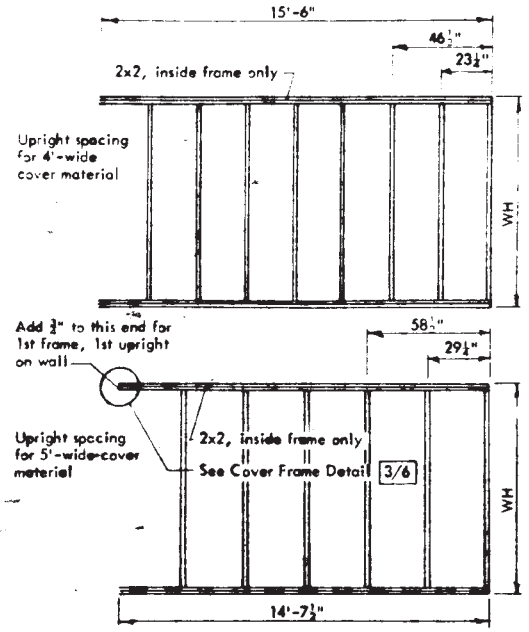


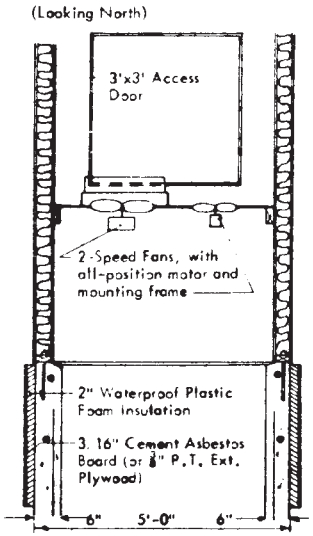
COLLECTOR COVER FRAME UNIT—1/6

Notes

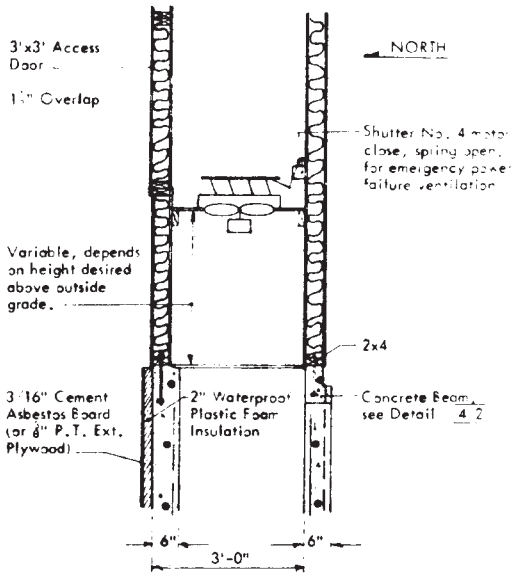
Make all joints in cover material at vertical supports.

Avoid long continuous runs of cover material or thermal expansion and contraction will pull it loose.

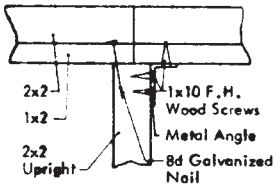
Provide an opaque cover for the collector during the summer months.



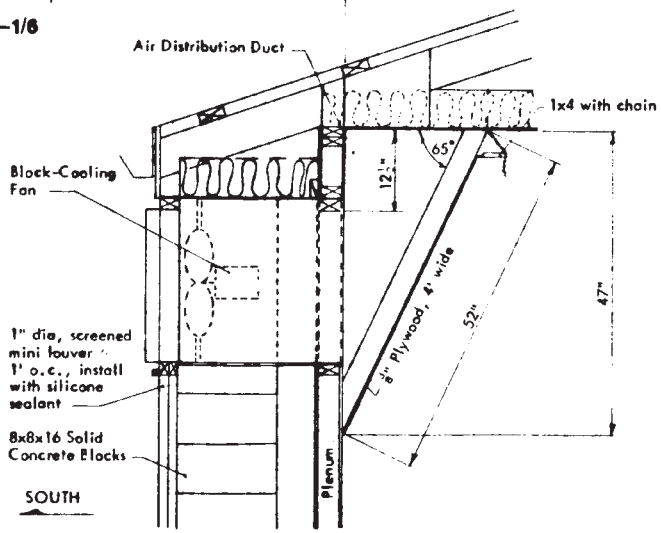
CHIMNEY CONSTRUCTION DETAIL—4/6



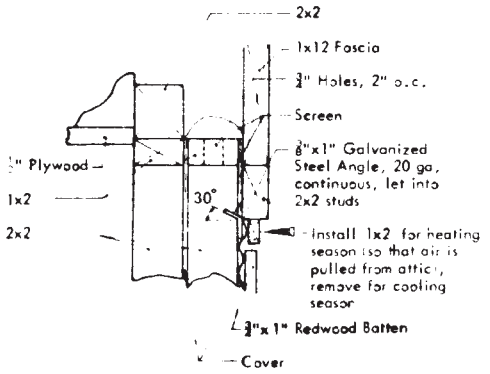
CHIMNEY CONSTRUCTION DETAIL—5/6



COVER FRAME DETAIL—3/6



SHUTTER OPENING DETAIL—6/6



CONSTRUCTION DETAIL—2/6

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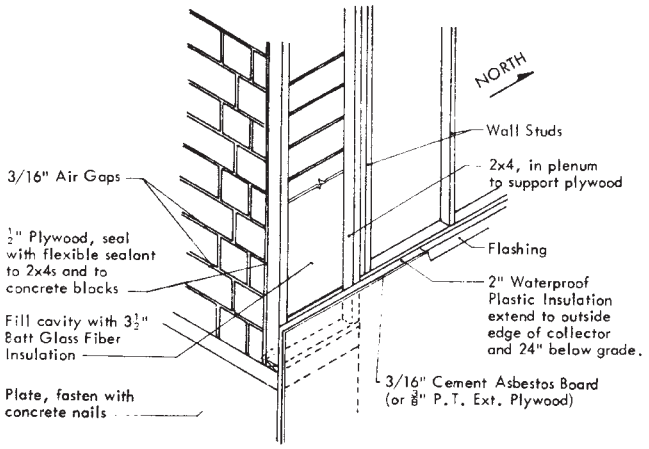
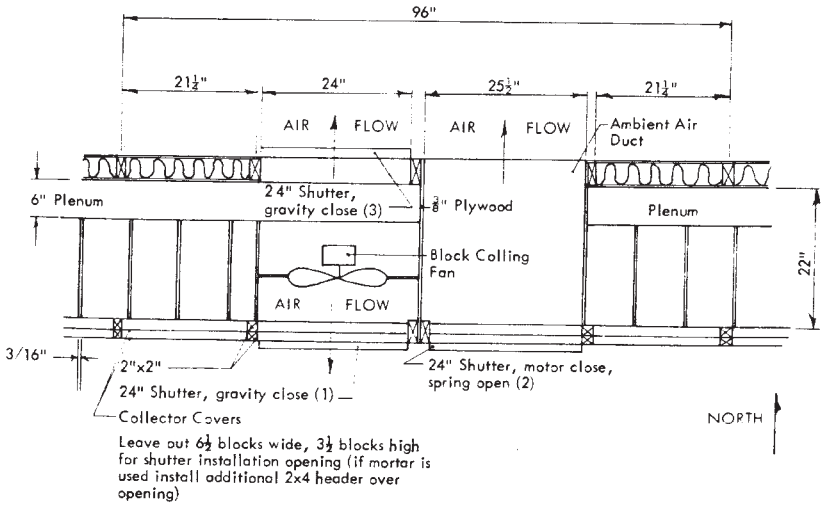
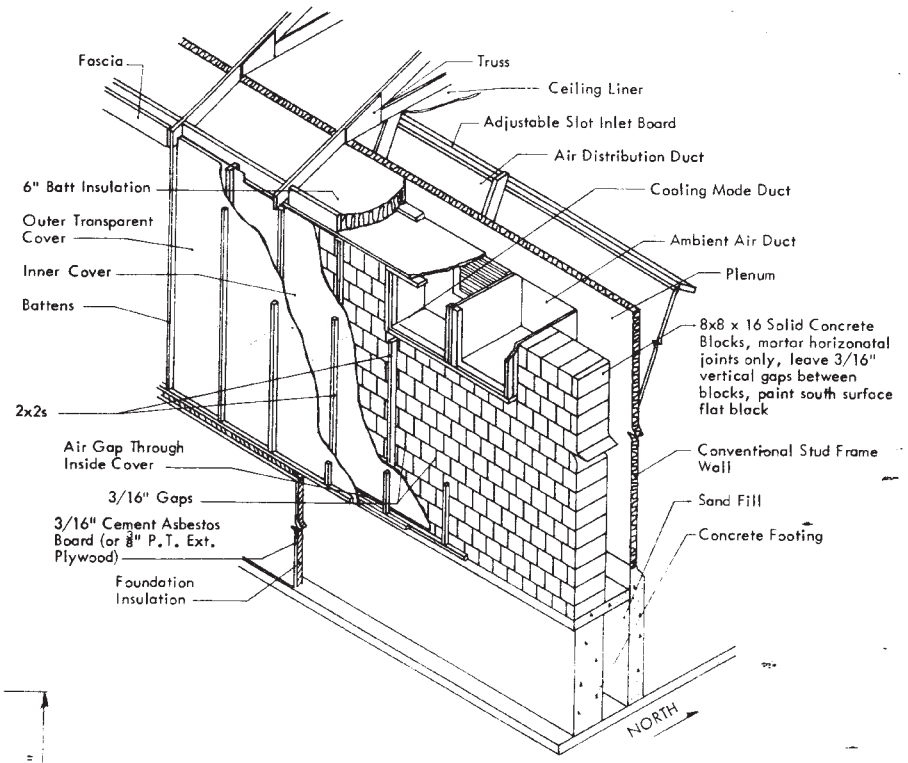


COLLECTOR END WALL—1/7



Leave out 6½ blocks wide, 3½ blocks high for shutter installation opening (if mortar is used install additional 2x4 header over opening)

SHUTTER OPENINGS DETAIL—2/7



SOLAR WALL DETAIL—3/7

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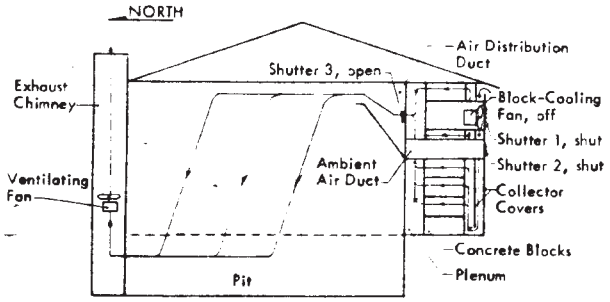
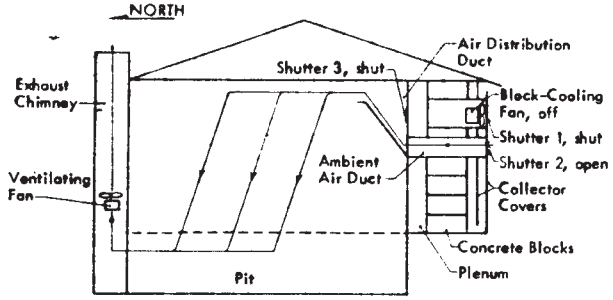
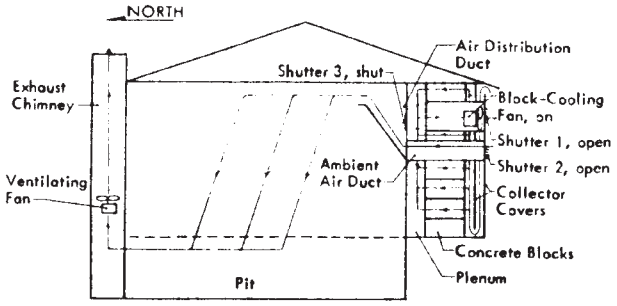


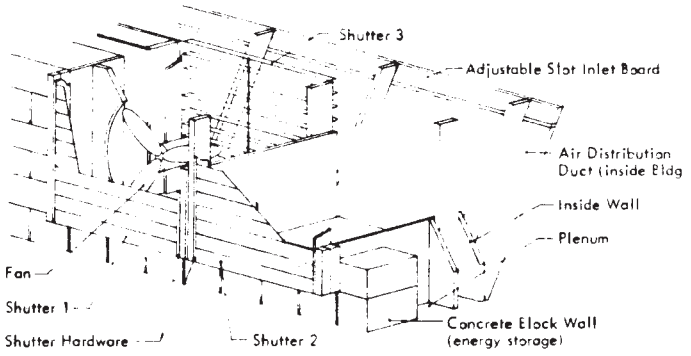
HEATING OR COOLING VENTILATING AIR—1/8



VENTILATION WITH AMBIENT AIR—2/8



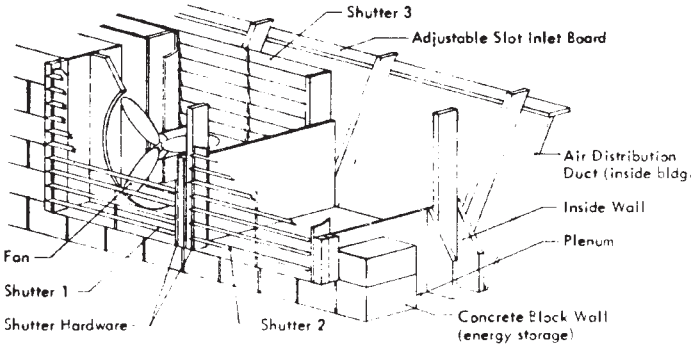
VENTILATION WITH AMBIENT AIR AND BLOCK COOLING—3/8



Winter Shutter Operation (Building equipped for summer cooling)

Winter Operation
- Normal (shown)—preheating ventilating air
  - Shutter 3 open to admit warmed air
  - Shutter 1 and Shutter 2 closed (see 1/8)
- Warm Weather—no heating demand
  - Shutter 2 open to admit ambient air
  - Shutter 1 and 3 closed (see 2/8)

Note:
Shutters 1 and 3 are gravity closed.
Shutter 2 is motor closed.



Summer Shutter Operation (Building with summer cooling)

Summer Operation
- Night (shown), storage being cooled
  - Shutter 3 closed
  - Shuter 1 open and fan operating
  - Shutter 2 open (to admit ambient air) (see 3/8)
- Day. Ventilating air cooled by storage
  - Shutter 1 and 2 closed
  - Shutter 3 open to admit cooled air (see 1/8)
- Emergency: Shutter 2 opens on power failure

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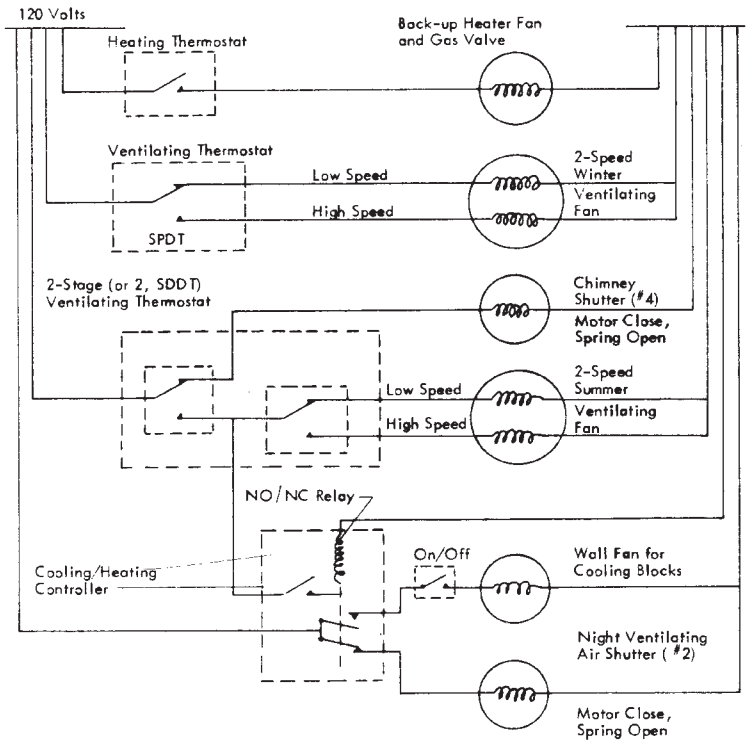


SCHEMATIC DIAGRAM OF CONTROL SYSTEM—1/9

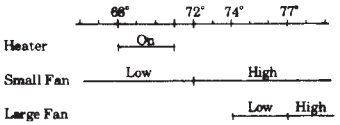
Operation and Control of the Building and Solar Collector

Two thermostatically controlled, 2-speed ventilating fans move from less than 20 to over 100 cfm per stall in four increments. The small fan is continuous except during power failures. It is adequate for moisture control during the heating season and except for rare occasions, runs on low speed throughout the winter months. The large fan is for temperature control during warm weather.

A block-cooling fan moves outside air through the solar wall on cool summer nights. The cooled blocks reduce the temperature of the daytime ventilating air by as much as 10°F.

Four shutters direct airflow for the various control schemes. Operation of Shutters 1, 2 and 3 is shown on p. 8. Shutter 4 prevents air from short circuiting when only the small ventilating fan is operating.

Winter—Heater and Fans



Wire heater and fan and set thermostats so equipment runs as illustrated above.

If the heater thermostat setting is changed for any reason, also change the two fan thermostats to keep the same temperature differentials.

Agricultural thermostats are often inaccurate. Experiment with your thermostats, if necessary, to obtain proper operation.

Summer

If the building is equipped with the summer cooling option, a differential controller is needed to sense whether ventilating air should be pulled through the concrete wall or brought directly from outside. The controller has two sensors, one for outside air and one for air leaving the solar wall.

- Order a differential controller with a 3°F differential (from a solar equipment manufacturer).
- Leave the controller in the automatic operation mode throughout the year.
- Install the outdoor temperature sensor outside the building in a shaded location with plenty of free air movement.
- Install the wall temperature sensor in the plenum between the solar wall and the building wall. Make sure the sensor is not touching either wall and air can circulate freely past it.
- Connect the controller so ventilating air is pulled through the solar wall when the large fan is running and while air from the wall is cooler than outside air. (See Schematic 1/9).

For summer operation, turn the block-cooling fan on/off switch "on." (Leave the switch "off" during the rest of the year.) Also, cover the solar collector or provide an overhang long enough to shade it most of the day. If properly installed, the system operates as shown on p. 8.