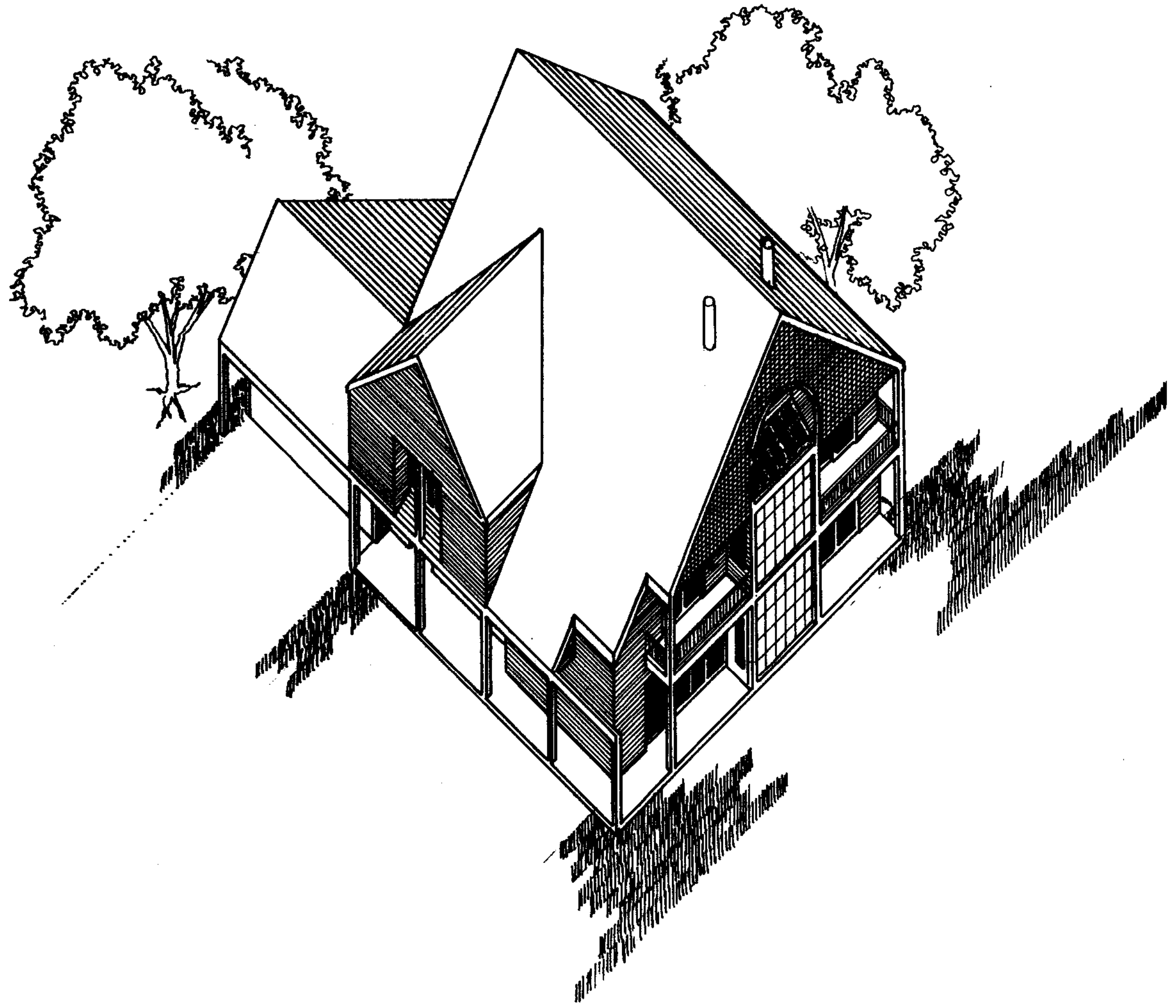
Foxboro, MA



Builder: Orlando Homes, Inc., Foxboro, MA

Designer: The Ehrenkrantz Group, New York, NY

Solar Designer: The Ehrenkrantz Group

Price: $130,000

Net Heated Area: 2443 ft^2

Heat Ld: 80.4 x10^6 BTU/yr

Degree Days: 4788

Solar Fraction: 46%

Auxiliary Heat: 3.7 BTU *IDO/ft^2*

Passive Heating System(s): Direct gain, isolated gain, sun-tempering

Recognition Factors: Collector(s): South-facing glazing, sliding glass doors, 331 ft^2 Absorber(s): Floor tiles over concrete slab floor, brick wall Storage: Concrete floor, brick wall-capacity: 8009 BTU *I* o F Distribution: Natural and forced convection, radiation Controls: Moveable insulation (pull-down shade), overhangs, sun screens, vents, thermostat

Back-up: Electric resistance heater, air-to-water heat pump (44,000 BTUIH)

Domestic Hot Water: 36 ft^2 liquid flat-plate collectors, 1 OO-gallon storage

This design illustrates a well-integrated blend of passive solar heating features and traditional styling. The 2-story, 4-bedroom house with cedar shingle exterior will be a part of a 25-lot development in which 19 homes have already been built and sold. The major passive design element is a 2story attached greenhouse set into an arched recess and flanked on either side by second-story balconies and porches. The garage and utility room are located along the north wall to protect against winter heat loss. Glazing on non-south walls has been minimized, and all windows and corners are caulked. Operable insulated shades protect all windows from winter heat losses and excessive heat gain in the summer. In addition, the glazing in the greenhouse can be covered with an operable slatted sunshade in the summer.

Direct solar radiation provides passive heating to rooms on both levels of the house. On the first floor, solar heat is collected directly through the recessed glass sliding doors on both sides of the greenhouse. On the western side of the house, sun shines into the living and dining rooms directly through double-hung windows. The family room, breakfast room, and kitchen **collect** heat and light from similar windows on the east side.

In the living and family rooms, solar heat is **absorbed** and **stored** in a floor that consists of a 5-inch concrete slab overlaid with a 2-inch quarry tile. The floor in the kitchen, breakfast, and dining rooms is hardwood with relatively low storage capability.

Each of the bedrooms on the second story also **collects** solar heat directly through glazing on the south, east, and west walls. The south-facing master bedroom and first bedroom each open onto recessed balconies through glass sliding doors that are directly above those on the lower level, and are identical in size. The second and third bedrooms open onto west-facing recessed balconies through glass doors; double-hung windows permit additional penetration of heat and light into the master bedroom

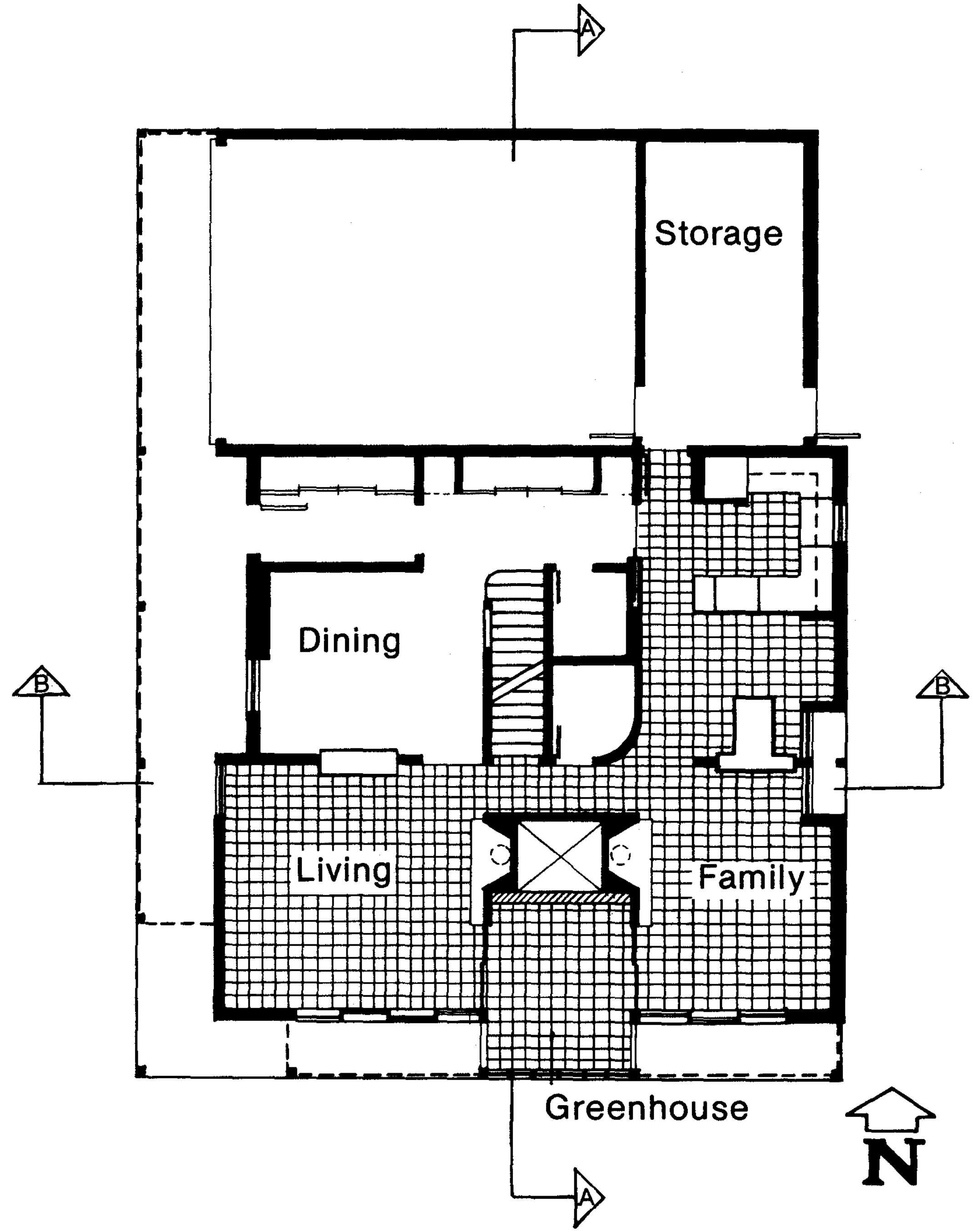
from the east. All windows and doors that function as passive solar collectors are double glazed. On the second story there is nominal storage for solar heat in the bedroom floors which have 2-inch quarry tile on top of a plywood subfloor.

At night, the heat that is stored in the mass floors of the living room, family room, and bedrooms is **distributed** to these spaces by radiation.

The 2-story, attached, greenhouse has fixed double-glazed **collection** windows on the front; its glass doors open onto porches on each side. Two of the interior greenhouse walls are made of 12-inch common brick.

On the first story, the third wall is a glass sliding door leading to the living room. On the second story, the third wall of the greenhouse is brick with a door opening into the first bedroom.

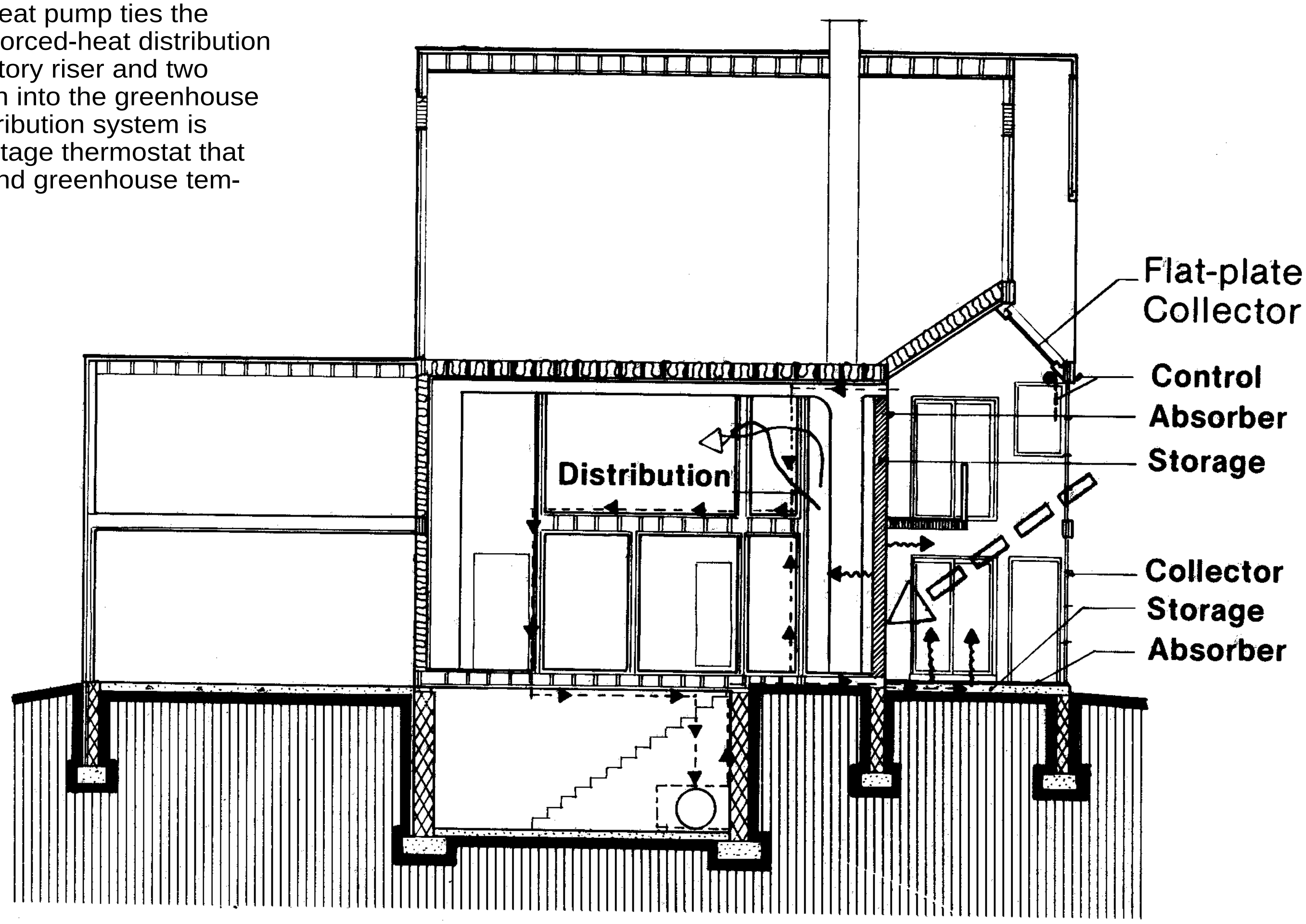
Like the rest of the lower-level south-facing rooms, the greenhouse has a floor of quarry tile on top of the concrete slab. These masonry floors and walls **absorb**



solar heat during the day and store it until temperatures drop in the evening. When interior temperatures are lower than the temperatures of the walls and floor, stored heat is radiantly **distributed** into the living and sleeping spaces. Additional heat **storage** is provided by the brick chimney mass and hearth located behind the greenhouse wall on the lower level. Undesirable winter heat loss is **controlled** by manually closing insulation shades over windows.

In the winter, transfer of passive solar heat is integrated with the **distribution** of heat provided by the back-up air-to-air heat pump in the basement. The ducting system associated with the heat pump ties the greenhouse into the forced-heat distribution system through a 2-story riser and two return ducts that open into the greenhouse floor. This hybrid distribution system is **controlled** by a dual-stage thermostat that senses both house and greenhouse temperatures.

When the house temperature falls to 72°F, the fan in the heat pump unit is activated. If the greenhouse temperature is greater than 75°F, a by-pass damper in the basement blower unit opens, allowing heated greenhouse air to circulate into dining and sleeping spaces through grilles under exterior windows. Cold air is returned to the blower through a central duct and then circulated to the greenhouse for reheating. If the temperature in the greenhouse is below 75°F, and the house temperature is above 70°F, the by-pass damper closes, isolating the greenhouse from the house. Air is then circulated only within the conditioned living spaces, distributing residual heat. When the temperature in the house falls to 70°F, heat from the auxiliary heat pump will be distributed to living space via the duct system. The heat pump will work in conjunction with the greenhouse as long as the greenhouse can provide useful heat. If the

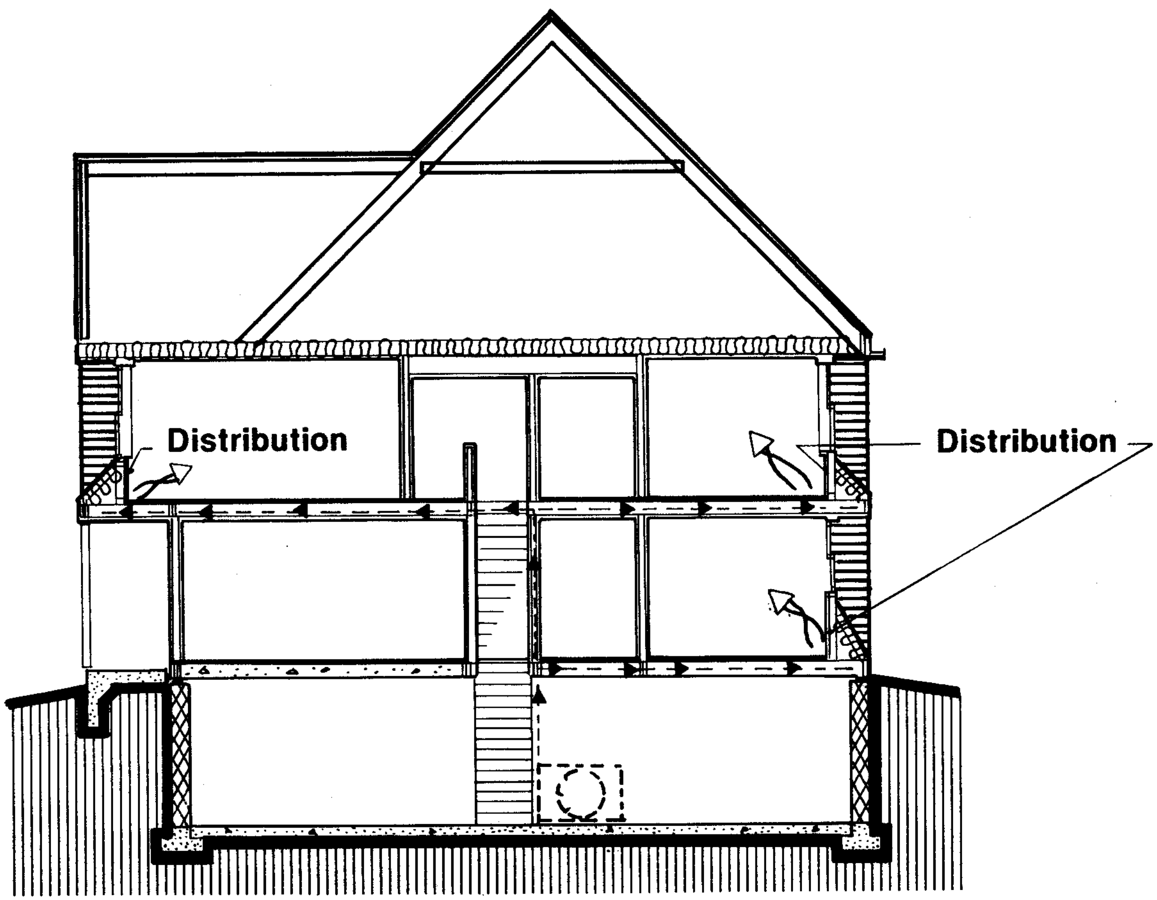


A-A

house temperature is above 72°F, the heat pump will shut off, but the fan will continue to circulate air until the house temperature reaches 74°F, at which point the blower will also shut off.

In addition to summer cooling provided by the heat pump, opening ground-level greenhouse doors and the attic vent will induce ventilation of the greenhouse. Crossventilation of the rest of the house is accomplished by opening north, south, east, and west windows and bedroom doors. An interior sunscreen can be manually closed across greenhouse glazing to reduce admission of direct sunlight.

A prepackaged active solar domestic water heating system has been included in the design. A Grumman collector with 36 square feet of exposed area is mounted inside the greenhouse, just beneath the glazed ceiling at an angle of 45 degrees from the horizontal. Installing the collector inside the greenhouse reduces heat loss to outside air. The heat transfer medium is a 40 percent solution of propylene glycol that also contains rust inhibitors. The stonelined, 100-gallon steel water storage tank is fiberglass insulated, and located in the first-story utility room.



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This plan is from the book
“Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes”,
The U.S. Department of Housing and Urban Development, **1982**

The solar homes designs in this book were the winners of HUD’s fifth (and final) cycle of demonstration solar homes. The 91 winning home plans in the book were selected from 550 applications from builders.

This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today’s passive solar designs.