14080 Crabapple Road

Passive Solar Home Overview

Construction & Design

Construction on this custom-built passive solar home began in 1979. The floor plan and elevation were developed through sketches and discussions between Kenneth D. Kirkland (original owner) and architect Robert R. Douglass. The lot was originally a horse property west of the Kirkland residence at 14070 Crabapple Rd.

The concept was to create a quasi-passive solar home heated primarily by the greenhouse (solarium). Engineer Malcolm Lillywhite, who worked for Martin Marietta, was engaged to design the passive solar elements. A special concrete block was used, featuring two channels—one for airflow and the other for insulation. The blocks were laid dry with leveling shims to reduce construction costs, though it was later realized that conventional cementing would have been more efficient.

The house was completed by the end of 1979 and occupied in early 1980.

Passive Solar Heating System

The home utilizes thermal mass, airflow, and insulation to regulate temperature naturally:

- A plenum system runs east to west beneath the house, accessible from the greenhouse duct cabinet.
- Concrete pipes buried in a 2-foot-deep bed of stones transport heat from the plenum to the north wall, where warm air rises through the inner chamber of the front wall blocks and circulates upstairs.
- The outer chamber of the front wall is insulated, along with the garage walls and west wall.
- The north exterior wall and fireplace area are covered with three inches of foam insulation and sealed for efficiency.
- The greenhouse walls are filled with sand for added thermal mass.

Originally, a small backup furnace was installed in the cabinet housing the water heater, but it was insufficient to heat the two north bedrooms and upstairs playroom/office. A boiler system was later added, supplying supplementary hot air through a heat exchanger and hot water heating for these rooms.

Winter Heating System

Two thermostats near the Library door control:

1. The greenhouse fan (upper thermostat)
2. The boiler and its fans (lower thermostat)

The greenhouse system activates when the solarium temperature exceeds 90°F. Air is pulled from the top of the greenhouse through the duct cabinet, where a large fan distributes heat throughout the house via the plenum. A filter and shutter regulate airflow.

When the greenhouse fan is running, the boiler fan is automatically disabled.

The boiler system activates when:

- The greenhouse temperature drops below 50°F
- The house temperature falls below the boiler thermostat setting

When engaged, the boiler:

- Supplies hot water to the heat exchanger
- Closes the greenhouse duct shutter
- Turns on the boiler fan and plenum fan
- Draws air through the ceiling vent outside the playroom/office, heats it via the heat exchanger, and distributes it through the home's ducts.
- Supplies hot water heating to the two north bedrooms and playroom/office

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How the System Works Year-Round

- Winter: The house absorbs daytime heat from the greenhouse and retains it overnight. The boiler supplements heat when needed.
- Summer: The house is cooled at night by opening windows and closed during the day to retain cool air. A window swamp cooler can be used when needed.

Winter settings:

- Greenhouse ventilator and chimney doors closed
- Upper greenhouse thermostat: 75°F
- Lower greenhouse thermostat: 70°F
- The boiler activates only if the house temperature drops below 70°F

Summer settings:

- Boiler turned off
- Attic fan trap door opened via rope and pulley system in the playroom/office

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Maintenance Schedule

Greenhouse Plenum Fan Filter

- Wash before winter and every 90 days

Greenhouse Plenum Fan (Lower Cabinet Door)

- Lubricate and check the belt before winter

Boiler & Fan

- Professional service by Sanders Johnson before winter

Heat Exchanger Filter

- Wash before winter and every 90 days

Attic Fan

- Trap door above the fan should be opened in summer and closed in winter
- Operated via rope and pulley in the playroom/office
- Factory-lubricated for lifetime use

Exercise Pool Maintenance

- Bromine tablets used instead of chlorine (to reduce odor)
- Automatic brominator checked every two weeks
- Filter changed regularly & washed down
- Pool runs automatically on a timer
- Vacuum as needed

This passive solar home was built with advanced engineering concepts for energy efficiency, blending innovative design with natural heating and cooling techniques. Its unique construction, combined with quality craftsmanship and thoughtful planning, makes it a one-of-a-kind home in Applewood.