

2. Operation

Once installed and powered, EcoSteam operates automatically without any input required from the user. This section describes the automatic functions of the EcoSteam controller, and status displays that can be viewed on the EcoSteam HMI.

2.1. Heating Cycle

A steam heating cycle consists of several "states". Each state is associated with a set of conditions that are observed or set by the EcoSteam controller. The states are:

- Idle
- Preheat
- Heating
- Heat Off
- Hold

2.1.1. The Idle State

In the **Idle** state, the boiler is off and is waiting for a "call for heat" to start a new heating cycle. When there is a call for heat, EcoSteam will run one or more heating cycles until the call for heat is satisfied.

The EcoSteam controller receives the call for heat from the home's existing thermostat.

2.1.2. The Preheat State

When a new heating cycle begins, the boiler must first deliver steam through all of the main piping before it can be delivered to the radiators for heating. This is called the **Preheat** state.

When the system enters the **Preheat** state, the burner is turned on and the Preheat timer starts.

The length of time in this state will vary depending on when the boiler last ran, and the temperatures of the boiler water and main piping at the start of the heating cycle. In winter months when the time between cycles is shorter, the **Preheat** time will typically be less than in spring or fall when the time between cycles is greater.

EcoSteam uses a thermal switch installed near the end of the steam main piping to detect when steam is present (see the **Installation** section for instructions on where to install the switch). There is also an adjustable maximum time limit for the **Preheat** state. The thermal switch is used again at the end of the heating cycle to ensure that the steam in the radiators has had a chance to heat the living space.

When the thermal switch detects the presence of steam, or the Preheat time elapses, the control will enter the **Heating** state.

2.1.3. The Heating State

When the **Preheat** cycle is complete, the burner remains on and timing of the **Heating** state begins. During this state, steam is being delivered to the radiators to heat the living space.

The length of time in the **Heating** state is determined by EcoSteam's proprietary outdoor reset algorithm. EcoSteam uses the outdoor temperature, the heat loss of the building, and the heating capacity of the boiler to calculate the **Heating** state time as a fraction of the overall heat cycle time.

When the **Heating** time elapses, the control will enter the **Heat Off** state.

If the call for heat is satisfied while still in the **Heating** state, the control will enter the **Hold** state.

2.1.3.1. Recovery from Thermostat Setback

If the optional indoor temperature sensor is installed, EcoSteam will calculate and apply a "recovery boost" to the **Heating** state, to allow the system to recover more quickly from a temperature setback.

2.1.4. The Heat Off State

When the **Heating** state is complete, the **Heat Off** state begins. In the **Heat Off** state, the boiler is off and will not run another heat cycle until the **Heat Off** time elapses.

The length of time in the **Heat Off** state is the difference between the overall heat cycle time (default is 30 minutes) and the calculated time of the **Heating** state.

When the **Heat Off** time elapses, EcoSteam checks the **Preheat** thermal switch. If the switch is off, indicating the main piping has cooled, the control will return to the **Idle** state. If the main piping is still hot, EcoSteam will enter the **Hold** state until the main piping cools. This serves to delay the start of another heating cycle until the steam in the radiators has been allowed to heat the living space.

2.1.5. The Hold State

Upon entering the **Hold** state, the boiler is immediately turned off and will not run another heating or DHW cycle until the **Hold** state is complete.

The **Hold** state can occur for several reasons:

- If a call for heat is satisfied while in the **Heating** state
- If high operating pressure is detected during the **Preheat** or **Heating** states (requires installation of the optional high pressure detection kit)
- If the **Preheat** thermal switch indicates the main piping is still hot at the end of the **Heat Off** state
- At the end of a domestic hot water cycle
- If the Request Hold setting on the EcoSteam HMI is turned on.

When the **Hold** state begins, a Hold timer is started. The control will remain in the **Hold** state until all of the following conditions are true:

- Hold time elapses
- High operating pressure is not detected
- The Preheat thermal switch indicates the main piping is cool
- There is no call for DHW

Activating the "Request Hold" setting on the EcoSteam HMI will force the system into the Hold state regardless of its current state.



Deactivating the "Request Hold" setting will cancel the Hold and the system will immediately return to the Idle state.

If the boiler was operating when the Hold was requested, it is recommended to wait a minimum of five minutes before resetting the request.

When the Hold state completes, the control returns to the **Idle** state.