Environmental Building Systems II: Assignment 1

Heating and Cooling Where You Live

Kasey Losik

ARC 3723

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Professor John Ross

STEP 1

TASK: Understanding the structure and spaces of your dwelling. Which type of building do you live in?

This is my house, 105 Apache, here in Starkville. The house has a wood-framed structure with a slab-on-grade foundation. The home qualifies as a “Type A” dwelling.

STEP 2

TASK: Identify the type of HVAC system you have and the location of the system/equipment and ductwork.

My house has a split-system central AC system. The heating furnace is located in a closet in the garage with easy access for maintenance (IMAGE 1). Burning natural gas ignites the furnace's burner. A metal heat exchanger is heated up while incoming cool air is brought to the exchanger. The air flows through the exchanger being heated. The furnace's blower pushes the heated air into the ducts and throughout the home.

The air conditioning unit is located on the outside of the home and refrigerant lines enter the homes and the supply ducts(IMAGE 2). Air is drawn into the device from the inside of the home where it is pushed over cooling evaporative coils. The coils absorb the heat from the air coming from the inside of the home. The system removes unwanted heat from the home.

IMAGE 1

IMAGE 2

STEP 2

TASK: Identify the type of HVAC system you have and the location of the system/equipment and ductwork.

The flex ducts carry and push conditioned air throughout the home (IMAGE 3) Conditioned air get delivered to the occupied spaces via supply vents (IMAGE 4). Used air from the home gets removed from the occupiable spaces via return vents (IMAGE 5). This air is sent to the air conditioning system where it is filtered and heated or cooled depending on the thermostat programming.

A natural gas fireplace also works to heat the home as a supplementary source (IMAGE 6). Natural gas is ran to the system and lite with a match. It can then be turned on or off by the user with a dial.

IMAGE 3

IMAGE 5

IMAGE 6

IMAGE 4

Kasey Losik

STEP 3

TASK: Locate your water heating system and identify the type (e.g., tank, tank-less, solar, etc.)

My home has a natural-gas hot-water heater tank (IMAGE 7). A flow sensor ignites the natural gas which warms a heat exchanger. Incoming cool water passes the heat exchanger and and leaves the hot water heater at a set temperature (adjustable).

Hot water travels through specific hot water pipes throughout the home to plumbing fixtures like sinks and showers. IMAGE 8 shows the two different cool and hot water lines under the sink in the kitchen.

IMAGE 7

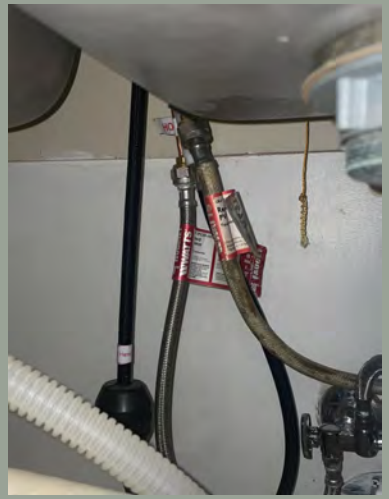


IMAGE 8

Kasey Losik

ACTIVES: ASSIGNMENT 1

HEATING AND COOLING WHERE YOU LIVE

outer cabinet

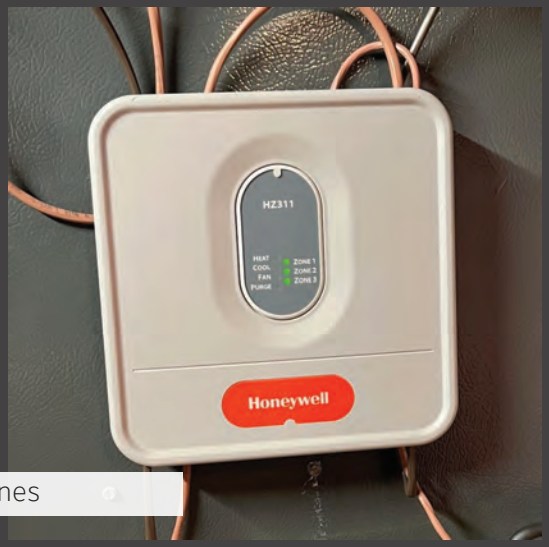
inner cabinet

My family home is a **Type A**, or house-like structure. It is an independent wood frame building with a slab on grade foundation. It is two stories with an attic, which contains the main system of the **central split system**. This is more energy efficient than a packaged unit system. In the above image, the **condenser and compressor are located in the outside cabinet**.

In the attic space, the **evaporator coil and air handler are located in the inner cabinet**(pictured above. A copper line set connects these systems and moves cold air into the house. The entire system can be controlled by a **digital thermostat**. There is one located on the first and second floor and they can be adjusted independently.

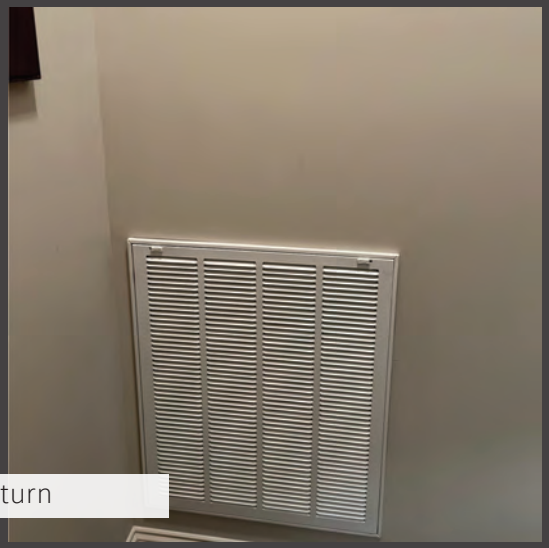
ACTIVES: ASSIGNMENT 1

HEATING AND COOLING WHERE YOU LIVE



zones

This is also a **zone system**, as seen in the photo to the left. The house is divided into 3 zones. This **improves the efficiency** of the system because dampers in the duct work can regulate and redirect air to specific areas of the house.

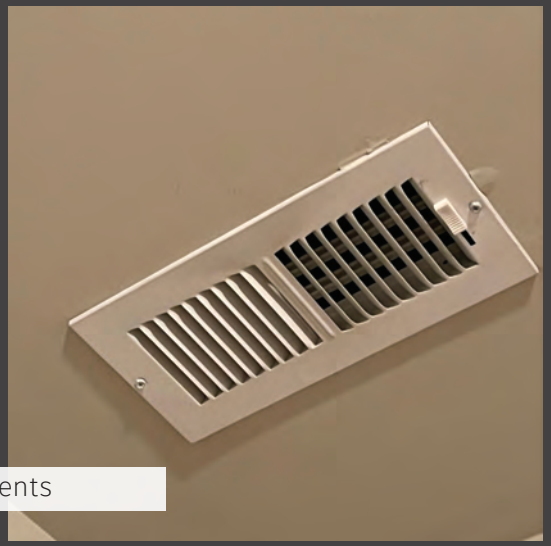


return

In addition, to the air vents this house also contains **air filtration in the return vents**. There air filtration vents located both upstairs and downstairs. This helps keeps the air clean and free of particles and impurities.

ducts

The air is run through the house via a **system of flexible duct work** from the inner cabinet in the attic. This runs through the registers and connects to the vents in the ceiling.



vents

The duct system connects to **air vents**, which are located in the ceiling through the house. They have **adjustable grills** that can be opened or closed. They allow the conditioned air to fall throughout the house while also intaking the resupply.

ACTIVES: ASSIGNMENT 1

HEATING AND COOLING WHERE YOU LIVE

Pictured to the right is the hot water heater. It is located in the garage of the house. It is considered an **electric storage hot water heater**. Water is heated through high-voltage electric heating rods that run vertically through the tank. Electric is safer and more efficient than a gas water tank.

It has a maximum capacity of 50 gallons. The tank is **adjustable through thermostats** located behind the panels as indicated. These control the flow of electrical current to the heating elements. Since this device has two, it is probably 240 V. The upper and lower thermostats each control one heating element(about 120 V each).

water heater

Assignment 1: Heating and Cooling Where You Live

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Becca G.

Step 1: My family home in Memphis, TN is a single-family house, closest in description to Type A. The structure is wood framing and the house sits on top of a crawl space. The primary structure is made up of wood studs, beams, joists, and sheathing. This house is two stories plus an attic space where most of the HVAC equipment is located.

Step 2: The HVAC system shown in pictures 5, 6, 7, and 8, is a central AC split system. By definition, an HVAC split system is one which "...holds the condenser and compressor in an outdoor cabinet. Another indoor cabinet will hold the evaporator coil, and an air handler sends the cool air through the duct system. A line set - a copper tube that connects both the indoor and outdoor components - moves cold air through the house." HVAC split systems are good for homes that have the space for large indoor cabinets. As my house has a large attic space where all of the equipment can be housed, it makes sense that it uses a split system. If the house didn't have an attic or other space inside, it would probably use a packaged unit to save space on the outside.

There is an element that is outside of the home in a split system. Shown in image 6, the air condensing unit cools down refrigerant and expels collected heat outside a home, while passing the refrigerant back inside where it cools down air in the unit shown in picture 7. Picture 7 also shows the unit that includes the gas furnace, which heats up the air and expels air with chemical vapors outside of the home in a fume tube. The hot and cold air passes through the duct system shown in picture 7 and 8 and comes out in air registers located on the bottom of the floor (shown in picture 4). The return registers (picture 2 and 3), take in the circulated air and return it through the system or expel it outside of the house. Image 5 shows the air filter which the return air passes through and filters out dust, hair, or other particles.

The temperature is controlled with the thermostat shown in picture 1. Changing the thermostat either triggers the furnace to begin heating up, or sends refrigerant out to the air condenser outside to begin cooling it down. The thermostat needs to be located in a central area of the house at eye level and away from and windows. This is where the temperature of the house is taken.

1


2


3


4

5


6


7


8

9


10


11


12

Step 3: The unit shown in picture 9 is the gas water heater. In each home with access to a main water line, water passed underground to a meter box outside the home. Two main lines pass throughout the home, a line carrying cold water and a line carrying warm water. The cold water line passes to the gas water heater, as well as to every other plumbing fixture in the house.

The warm water line branches off from the water heater unit and runs parallel to the cold water lines to every plumbing unit.

The water in my house is a gas powered water heater, which uses natural gas to heat air flowing through a central chamber inside the water heater. This warm air heats up the cold water that passes through the water heater. Because the cold water needs to be heated it, warm water may take longer to pass through the pipes.

These pipes typically run inside the walls in every building. Thus is why you typically want to keep the plumbing along the same walls so you don't have so many branching water pipes through a building. Pictures 10, 11, and 12 show the pipes existing the wall and servicing the plumbing units. You can see two distinct tubes which carry the warm and cold water separately.

ASSIGNMENT 1 - HEATING AND COOLING WHERE YOU LIVE

HEATHER PAPIZAN
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DEAVENPORT HALL

Deavenport Hall is a Type B residence hall with a little over 200 rooms. There are four stories and 2 main wings with a lobby that connects both wings Each wing has an air handler that blows air over heated or chilled pipes providing heating and cooling for the entire wing. The primary structure is light-gauge steel framing. For the foundation, there is a partial basement that contains a utility room with the rest of the foundation being slab-on-grade.

HVAC SYSTEM

Each wing has an identical system to heat and cool the spaces. Above each wing is an attic space that contains the air handler for the wing. It heats and cools the spaces by passing air over chilled or heated pipes. Inside the basement, there is a boiler assigned to each wing providing a heated water supply to the air handler and a water chiller providing a chilled water supply. The administrator will choose if the air handler is heating or cooling the air. In each room is a thermostat that lets the user chose a temperature between 68 to 74 degrees. The the air handler uses both ridged and flexible ductwork with separate ductwork for the exhaust and outside air. The duct work branches off from the main system for each floor/room. In each room, there is flexible ductwork that connects to the vent that supplies air for the entire room. Located inside each room at the front is the grille for the return air.

Inside specific rooms and the lobby area there are smaller packaged systems that heat and cool those spaces. These system can toggle between heating and cooling the space autonomously from the main unit according to the thermostat that can be set for temperatures between 68 to 74.

AIR HANDLER SYSTEM

HEATED AND CHILLED WATER SUPPLY PIPES

WATER CHILLER FOR CHILLED WATER SUPPLY

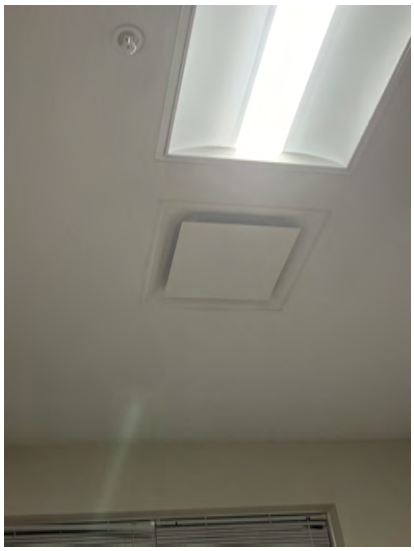
INDIVIDUAL ROOM DUCT WORK

EXHAUST AIR DUCT WORK

BOILER FOR HEATED WATER SUPPLY

INDIVIDUAL ROOM TEMP. CONTROL THERMOSTAT

INDIVIDUAL ROOM RETURN SUPPLY GRILLE



INDIVIDUAL ROOM VENT

OUTSIDE AIR SUPPLY DUCT WORK

CHILLED WATER SUPPLY PIPES (BASEMENT)

WATER HEATING SYSTEM

There are two main storage tanks that are located inside the basement utility room. Each wing has a one water heater that supplies all the rooms in that wing. The fuel for the water heater is supplied by a natural gas line.

WATER HEATER STORAGE TANK WITH NATURAL GAS LINE

DOMESTIC HOT WATER PIPES