**The 9 most common HVAC Design Flaws – Health and Safety Issues and System Killers that can be evidenced by photographs**

****

**Example 1:**

The rusty cabinet (Air handler or furnace): (Take a photograph of the rusty cabinet)

Symptoms:

Odors, allergy triggers, excessive dust.

Situation: Rust on the bottom of the cabinet of a furnace resting on a concrete floor.

Ask your customer “What does this look like on the bottom of your furnace?” while pointing to the rust in the photograph. They will say “Rust?” you say “that's right. What’s happening is:”

Cause: “Moisture from the concrete wicks up through the insulation on the inside of the blower compartment and causes the metal cabinet to rust out.”

Problem: Mold and mildew grows in dark damp places just like the inside of the blower compartment (take photograph illustrate) what does that look like?”...”Right.” “When the blower turns on, where does that go? (Let the customer answer the question then reply) that's right. It gets distributed throughout your home. Could this be contributing to your the allergy symptoms, dust and odors?”

Solution: “When we install your system, we will set the indoor unit on a plastic pad that will serve as a moisture barrier to prevent this from happening. Can you see how that will reduce allergy triggers, dust and odors in your home?”

**Example 2:**

The 90-degree return drop:

Symptoms:

Noise, increased operating costs, excessive dust, longer run times, reduced heating and cooling capacity, uneven temperatures in the home.

Action:

Take a photo of the transition, the air filter and spotlight the patterns of the dirt captured on the filter. Often times, due to the air turbulence, half of the filter will load up first because air takes the path of least resistance. Once it loads up, the velocity of the air will cause most of the dirt to blow through the filter.

Cause: The air takes an indirect route to the blower intake making the system work harder to move and creates an uneven distribution of air in the home.

Problem: Reduction of filtering capability, uneven air distribution, increased noise and higher cost of operation.

Solution: Install a new return airdrop with a sweeping 90-degree radius elbow into a sealed external filter rack making it easier for the blower to evenly pull the air through the filter and distribute it throughout the home. Can you see how this will improve the filtering capability, reduce operating cost and help even out hot and cold spots in your home?

**Example 3:**

Restricted return air drop (Return duct drop too small):

Symptoms:

Noise, increased operating costs, excessive dust, longer run times, reduced heating and cooling capacity, uneven temperatures in the home.

Action:

Take a photo of the drop, the air filter and spotlight the patterns of the dirt captured on the filter. Often times, due to the air velocity, the air filter will load quickly causing contaminants captured on the filter to “blow through” or “Bypass” the filter, contaminate the HVAC system and blow into the home through the supply registers.

Cause:

The heating and air-conditioning blower pulls air from the house through return air grills, into the return air ductwork, then it enters the return air drop which connects the ductwork to the blower compartment. If any part of that return system, the grills, the ductwork or the return air drop is too small, your heating and air-conditioning system will have to work harder to circulate enough air to keep your home comfortable. Improperly sized duct work causes increased operating costs, excessive dust, longer run times, reduce heating and cooling capacity and uneven temperatures in the home.

Let me give you an example:

“Imagine trying to breathe through a coffee stirrer straw.

You have to agree that would be a very difficult task right? That is how hard your blower has to work when the ductwork is too small. Can you see how that is creating some of the problems you are experiencing?”

Now imagine breathing through a big gulp straw. That would be much easier and much more comfortable wouldn’t it?” You would have to agree that properly sizing the return drop will help your new system perform much better than if the duct design were left the way it is, right?”

Solution:

“When we install the proper signs return air ductwork to your new furnace, your system will be quieter, filter the air better, maintain better temperature throughout your home and cost less to operate. Does that make sense?”

**Example 4:**

**Leaking ducts in unconditioned attic space:**

Symptoms:

Increased operating costs, excessive runtime, excessive dust, and increased allergy triggers and poor humidity control.

Action:

Take photographs of leaking ductwork. An easy way to illustrate lakes is to insert an object into the leaking hole such as a pen or pencil, screwdriver or any type of item that will illustrate a leak. Take photographs of air leaks and the duct system in general.

Cause:

The blower pulls air from the house through return air grills, into the return air ductwork located in your attic, then it enters the return air drop, travels through your air filter to the blower compartment. The blower pushes the air through your furnace, your air conditioner coil, through your supply ductwork where the air is distributed throughout the home.

I found several leaks in the ductwork as you can see by these photographs. There are 15 to 20 holes just like these. Each hole represents about 1% of the air that is being pulled from your attic. So, if we add up all of the 15 holes I found, what percentage of the air is being distributed into your home from your attic?

What temperature is your attic in the summer?...and in the winter? Right.

Can you see how much harder your system has to work to keep your home comfortable if 15% of the air it is heating or cooling is coming from the attic? Not to mention the additional cost of operation.

What else is in your attic?

What kind of insulation is this? Right.

The ductwork is also pulling insulation, dirt, dust and allergens from the attic area, into your filter. Now, (hold up the air filter) we can literally see through this filter. In fact, if we poured salt on this filter, the salt would fall right through, right?

Can you imagine how much of the dust, insulation particles and allergen particles have been blowing through your filter and distributed through your home?

To make matters works,15 to 20% of the conditioned air that should be going into your home is being lost into your attic because of the leaks on the supply ductwork. That reduces the capacity of your furnace and air conditioner by 15 to 20% which makes it difficult to maintain even temperatures and may cause the home to uncomfortable in extreme temperatures.

Can you see how sealing and insulating the ductwork and Installing a hospital grade air filter along with an airtight filter cabinet will:

Reduce allergy triggers, Minimize dust, Help even out hot and cold spots and reduce operating cost? Does that make sense?

**Example 5:**

Horizontal air handler suspended in attic with inadequate supports:

Safety issues:

When horizontal units are suspended from rafters in attics, they should be supported in a fashion that prevents the unit from buckling in the middle. Often times, horizontal units are supported on each end, putting pressure and weight in the middle of the unit causing it to buckle. One indication of this is that the doors will not align with the original screw holes creating air leaks, condensation leaks and eventually, property damage.

Additionally, there should be a secondary “safety” condensate drain installed underneath the horizontal air handler to minimize the possibility of water damage to ceilings. Condensate drains are more likely to “stop up” when air handlers are located in attic areas due to the conditions of the attic area.

Symptoms:

Water leaks, Increased operating costs, excessive runtime, excessive dust, and increased allergy triggers and poor humidity control.

Solutions:

A secondary drain pan, safety switch that turns the air conditioner off when it senses moisture in the secondary drain and properly supporting the unit in a fashion that prevents it from “buckling” in the middle will solve this problem.

Duct sealing and insulating is also highly recommended.

**Example 6:**

Dirt streaks coming from supply diffusers or grills story:

Symptoms:

Excessive dust, and increased allergy triggers and poor humidity control.

Action:

Take photographs to illustrate the situation.

Cause:

Often times when supply registers or diffusers are installed, there are air gaps between the duct fitting and the register. Removing the register or grill will expose those gaps. As the air blows through the register or grill, it pulls air from the gaps creating dirt streaks on ceilings and registers. The air coming from the gaps often times carry allergens, dust and contaminants since that air usually comes from the area surrounding the ductwork, usually the attic, crawlspace or basement.

Solution:

Seal all air gaps between the duct fitting (supply boot) and the drywall to prevent air from being pulled into the conditioned space.

**Example 7:**

Un-level outdoor unit:

Issue:

Increased operating cost, excessive noise, reduces life expectancy and increases the work load on the air-conditioning system.

Action:

Take photographs to illustrate the situation.

Cause:

Oil, stored in the bottom of the air-conditioning compressor is used to lubricate the mechanical components of the unit. Oil is either distributed to those components from a small suction tube or by immersing a devise that mechanically distributes the oil. When an outdoor unit becomes out of level, the air-conditioning system is unable to distribute the proper amount of oil to lubricate the mechanical parts causing premature wear and tear, increased operating cost, excessive noise and ultimately, failure.

Solution:

Install the outdoor unit level and in a fashion that prevents it from becoming out of level due to thawing, freezing or erosion of the soil.

**Example 8:**

Excessive refrigerant lines solder connections:

Issue:

When copper is welded, the copper oxidizes. Oxidation is to an air-conditioning system as cholesterol is to a human heart. Too much of it at once or small amounts over a period of time will cause damage or failure.

Solution:

Install the lines with as few solder connections as possible by using copper tubing benders.

Purge lines with a small amount of nitrogen while making the solder connections to eliminate oxidation inside the copper lines.

Pull a vacuum on new lines before opening the refrigerant valves.

**Example 9:**

Leaky ducts located in garage:

Symptoms: Increased operating costs, excessive runtime, excessive dust, and increased allergy triggers and poor humidity control, possible CO levels in home.

Action: Take photographs of leaking ductwork.

Cause: The blower pulls air from the house through return air grills, into the return air ductwork located in your attic, then it enters the return air drop in your garage, travels through your air filter to the blower compartment. The blower pushes the air through your furnace, your air conditioner coil, through your supply ductwork where the air is distributed throughout the home.

I found several leaks in the ductwork as you can see by these photographs. There are 15 to 20 holes just like these. Each hole represents about 1% of the air that is being pulled from your garage area. So, if we add up all of the 15 holes I found, what percentage of the air is being distributed into your home from your attic and garage? What temperature is your attic and garage in the summer?...and in the winter? Right.

Can you see how much harder your system has to work to keep your home comfortable if 15% of the air it is heating or cooling is coming from the attic? Not to mention the additional cost of operation.

What else is in your attic and garage? Right.

The ductwork is also pulling insulation, dirt, dust and allergens from the attic and garage area, into your filter. Now, (hold up the air filter) we can literally see through this filter. In fact, if we poured salt on this filter, the salt would fall right through, right?

Can you imagine how much of the dust, insulation particles and allergen particles have been blowing through your filter and distributed through your home?

 When you start your car in the morning or turn in off after you pull it into the garage, often times the exhaust fumes get drawn into the ducts when the blower is running along with the other chemicals and cleaning supplies increasing allergy triggers and odors. To make matters worse, 15 to 20% of the conditioned air that should be going into your home is being lost into your attic because of the leaks on the supply ductwork. That reduces the capacity of your furnace and air conditioner by 15 to 20% which makes it difficult to maintain even temperatures and may cause the home to uncomfortable in extreme temperatures.

Can you see how sealing and insulating the ductwork and installing a hospital grade air filter along with an airtight filter cabinet will: Reduce allergy triggers, Minimize dust, Help even out hot and cold spots and reduce operating cost? Does that make sense?