The Facts About Clothes Dryer Exhaust Systems

by John Cranor Published April 2005

What causes the fires?

The U.S. Consumer Product Safety Commission estimates that in 1998, clothes dryers were associated with 15,600 fires, which resulted in 20 deaths and 370 injuries.

Lack of maintenance is the major factor contributing to fires, but poor installation and/or the use of improper duct material also play a role. A dryer's lint filter catches only a fraction of the lint produced in the drying process, although some are better than others. Over time, the lint accumulates throughout the dryer and the duct system, reducing airflow, which causes the dryer to operate at elevated temperatures, thereby increasing the chance of something malfunctioning and/or the lint catching on fire. Dryer fires usually start beneath or inside the appliance. The draft from the dryer then forces the fire into the exhaust duct and, in many cases, causes a house fire. The probability of the fire spreading greatly increases with the use of plastic or Mylar (foil) ducts, with plastic being the most hazardous.

According to U.S. Consumer Product Safety Commission research, a 75 percent blocked dryer exhaust duct elevates the exhaust air temperature of the average electric dryer 89 percent more than its normal operating temperature with an unblocked duct.

Home inspectors and hazards

I am confident most home inspectors would put recognizing potential hazards in a house at the top of their list of priorities. Nevertheless, not everyone realizes the hazards presented by the clothes dryer exhaust system.
All too often, dryer exhausts ducts are not given due respect. They receive little to no consideration in the design stage, are often installed haphazardly, and are seldom maintained. Once installed, the ducts are rarely given another thought. Current lax attitudes about dryer exhaust ducts need to change! Home inspectors can help by familiarizing themselves with the current standards and the related issues, by learning to recognize symptoms of potential hazards and, most importantly, by educating others.

Why now?

Historically, clothes dryers were located a short distance from an outside wall. Their short, straight exhaust duct runs worked well, leaving little need for maintenance and making inspecting easy.

Today, I find laundry rooms located practically anywhere in the home. It's commonplace to find the dryer installed on an upper level with a long, concealed run including several elbows, often resulting in slowed and restrictive airflow. Given the tightness of modern homes, proper handling of dryer exhaust has become even more critical than it was in older homes that breathed.

Problem conditions

Most often, the dryer is pushed as close to a wall as possible, with a crushed or kinked transition duct, which immediately slows the flow of air and creates a trap for lint to collect. The transition duct should not exceed eight feet in length, should be of UL-approved material (not plastic), limited to a single length, and not have any part concealed within construction. Periscope-type connectors (sometimes called Banjos) eliminate the common problem of kinked and crushed transition ducts behind the dryer. Metal foil tape should be used on the ends of the periscope to seal any cracks. Air leakage disrupts the efficient flow of air.

Dryer exhaust ducts in many homes tend to sag because they are not guided through the rafters or otherwise properly supported, make sharp turns or hump up. Sharp turns, humps and sags create turbulence, preventing all the moisture and lint from blowing out.The common spiral-ribbed flexible ducts by mere design create turbulence and reduce airflow. All too often, the termination sleeve on this type of duct gets bent inward when it's installed, creating a dam for lint to snag. Some older termination hoods are restrictive by design, not allowing the damper to fully open. These common conditions, as well as exceeding recommended lengths and failing to perform routine maintenance, all increase the potential for lint becoming trapped within the duct system, leading to blockage.

What's being done to help reduce dryer fire risks?

The slow elimination of dangerous dryer exhausting products from the market over the last two decades has been the most significant step toward reducing fires. Years ago, the standard dryer duct was a white vinyl spiral wire duct. Not only was the vinyl susceptible to overheating and melting, the spiral "ribbed" construction created turbulence, reducing airflow, leading to lint accumulations within the ribs.
A Mylar-covered spiral wire duct replaced the white vinyl duct. Mylar is a shiny metallic-coated polyester film (often called foil), and it is slightly more heat-resistant than vinyl, but still presents potential problems for many of the

same reasons.
The use of metal exhaust ducts is now the widely accepted standard, recommended and/or required by Underwriters Laboratory (UL), the Association of Home Appliance Manufacturers, the Consumer Product Safety Commission, most (if not all) dryer manufacturers and most building codes. The use of an all-metal (rigid or semi-rigid) dryer exhaust duct helps to achieve optimal airflow, reducing lint buildup and reducing the operating temperatures of the dryer.

Warning Signs!

Clothes take an unusually long time to dry
Clothes are hotter than usual at the end of the cycle
Outside of dryer is unusually hot
Damper (or flappers) on exhaust termination doesn't open or barely opens when dryer is on
Laundry room feels warmer or more humid than normal
Unexplained moisture stains appear in concealed dryer exhaust duct area
Burnt smells in laundry room

Current industry standards

Industry standards provide an example of what can be done to reduce the potential hazards associated with the exhaust from clothes dryers.

The dryer exhaust system must be independent of all other systems and convey the moisture and any products of combustion to the outside of the home. The duct must not exhaust to attics, crawl spaces, basements, chimneys, the cavity of any wall or any interior room.

- Dryer duct must be at least 4 inches in diameter or at least the size of the dryer outlet. The exhaust duct must not extend into or through HVAC ducts or plenums. The exhaust duct system should be supported and secured.
- The maximum length for a clothes dryer exhaust duct should not exceed 25 feet. This length should be decreased by 2.5 feet for every 45-degree bend the duct makes, and 5 feet for every 90-degree bend the duct makes. This does not include the transition duct.
- The dryer exhaust duct should be constructed of rigid metal (aluminum or galvanized steel). The interior of the duct should be smooth surfaced with the joints running in the direction of the airflow. There should be no sheet-metal screws, rivets or any other fastener used to connect the duct joints. Fasteners that extend into the airway will catch lint and obstruct airflow. Clamps or foil duct tape should be used to secure joints.
- Outside termination must be equipped with a back draft damper, which prevents moisture/air intrusion and the entry of small animals. The termination must not have a screen covering the exhaust outlet.

Exception

Clothes dryer exhaust ducts should always be installed in accordance with the manufacturer's instructions. If the make and model of the dryer is known, the manufacturer's instructions override the standards. This is true even if the manufacturer's instructions are more lenient, which they often are. Some allowing the length of the duct to exceed the standard by as much as three times the standard's 25-foot maximum. Manufacturer's instructions may specify avoiding 90-degree turns, or approve semi-rigid duct, while specifying it should be fully extended. Instructions may specify that semi-rigid cannot be used in concealed areas, or that clamps must be used at joints without tape, or they may specify tape or clamps. At least one specifies that ducts in unconditioned spaces should be insulated.
When the manufacturer is unknown or the instructions are unavailable, industry standards and good practices provide guidance on how exhaust systems should be configured.

Good Practice

- If possible, rigid aluminum or rigid galvanized steel duct should be used (especially if concealed). If flexible metal duct must be used, use the semi-rigid type.
- The dryer duct should be as straight and short as possible. Minimize 90-degree turns. Sharp turns cause back pressure and create resistance to airflow. Two 45-degree bends are more efficient than one 90-degree bend. For best performance, separate all turns by 4 feet of straight duct.
- Duct joints should be wrapped with foil tape to make air and moisture tight. Avoid the gray duct tape as it will deteriorate over time.
- The hood should have at least 12 inches of clearance between the bottom of the hood and the ground or other obstruction. The hood opening should point down.
- Ducts should always have adequate support, especially at each joint.
- A dryer duct should never exhaust near the fresh air intake of a high-efficiency furnace, water heater or any HVAC intake.

- Rigid seamed exhaust duct ideally should be installed with the seams up to prevent any accumulation of condensation from seeping out. When possible, horizontal runs of dryer ducts should slope slightly downward (1/4 inch per foot) toward the exterior termination to reduce the possibility of condensation accumulating and collecting lint.
- In cold climates, insulating the dryer exhaust duct in unheated spaces may help to limit the condensation from forming inside the duct and collecting lint. Note: At least one dryer manufacturer specifies this in its installation instructions.
- Exhausting a dryer near or next to an air conditioning or heat pump condensing unit should be avoided. The expelled lint can collect and clog the condenser fins and will likely require continual condenser cleaning.
- Maytag® recommends checking the static pressure in the dryer duct (within two feet of the dryer) while the dryer is running with no load. Static pressure can be measured using a manometer and, according to the dryer manufacturer Maytag, it should be no greater than .6" (1.5cm) if the system is functioning correctly.

Be aware

- The common Mylar (foil) and white plastic spiral flexible ducts contribute to poor dryer performance. These spiral ducts are no longer recommended and will void the warranty of most (if not all) dryers, if used.
- The use of PVC pipe is not recommended, and is against all standards and specifications.
- Magnetic dampers on exhaust hoods are restrictive and should not be used on dryer exhaust systems.
- Venting up or through the roof, although possible, should be a last choice. These systems clog up faster and demand close monitoring and routine cleaning for safety and efficiency.
- Dryer exhausting through the roof should be ducted to a special dryer roof vent without screen. The roof vent or louvered plenum must be equivalent to a 4 inch wall termination in regard to resistance to airflow and back-flow prevention, and should require little or no maintenance to prevent clogging.
- The older dryer exhaust hood terminations have a 21/2 inch hood opening that is restrictive by design; often clogging and sticking open. The newer versions have a full 4 inch hood opening or a series of flappers allowing unrestrictive exhausting and improved performance.
- Mobile home exhaust ducts must be secured to the home and should not discharge under the home.
- Clothes dryers require make-up air; if the laundry area is too tight, it will affect the operation and function of the dryer exhausting. In addition, dryers operating in utility areas with gas appliances that lack sufficient make-up air can create a dangerous back-drafting (CO) problem.

What about vent buckets or lint traps?

Sold in hardware stores everywhere, a vent bucket (aka lint trap) is a device that you fill with water, connect to a clothes dryer duct and hope the water collects the lint. Although widely used, especially in older homes, they are not recommended. They have a limited ability to catch lint, while allowing gallons of water to be pumped into the home and create a potential air quality issue. Whether it will have a negative effect depends on a number of factors such as the climate, how often the dryer is used, and so forth. Another popular home remedy is to use a woman's nylon stocking to filter lint—also not recommended; it creates a fire hazard!

Dryer Exhaust Booster

Booster fans can be used to exceed the maximum 25 feet or to help with vertical applications. The recommended location of a booster fan is a minimum of 15 feet from the dryer outlet. If mounted closer, it may create enough pressure to lift or pull wet lint into the fan impeller, resulting in excessive lint loading in the fan. The best location for mounting the fan is as close as possible to where the duct terminates. (Exception: If a secondary lint filter is installed between the dryer and the booster fan, the mounting location can be within the 15-foot minimum distance. The fan must be mounted securely and must be accessible to perform recommended maintenance. If the fan is not readily accessible from the dryer room, it is recommended that a permanent label be placed near the dryer transition duct stating that a remote booster fan is used. A pressure switch activates a booster fan automatically, and the fan cycles on and off in 10 minute intervals. Angled and horizontal mountings are possible, but vertical mounting is recommended to reduce condensation buildup
in the fan. Horizontal mountings require a 1/4 inch hole drilled in the bottom (along with the proper drain insert and drainage tube) to allow condensation to drain.
The diaphragm pressure switch should be positioned vertically for optimum sensitivity.

Dryers deserve a closer look

It is more necessary today than in the past to have a clothes dryer exhaust systems inspected. Such an inspection is critical today because newer houses tend to have dryers located farther away from an outside wall; therefore, dryers tend to be vented for longer distances, and ducts are more often installed with sharp turns and bends to accommodate the structure of the home. As a result, dryer ducts have more places to collect lint, and small animals and birds have more room to hide or nest. Also, there are more gas dryers being used today– just another reason why dryer exhaust duct systems warrant a closer look.

The dryer duct is sometimes concealed and beyond the scope of the inspection, making a thorough inspection difficult, but an alert home inspector can be watchful for the warning signs and aware of the issues. An inspector can also be alert to the obvious and the not- so-obvious, refusing to assume the exhaust duct is safe or connected or that it runs from point A to point B.

People die, property is destroyed and energy is wasted as a result of inadequate or clogged dryer ducts. Unlike many issues we report on, this one has a relatively easy and economical solution. If it's dirty...clean it! If it's not up to standard or no longer considered safe.... have it replaced or corrected! If you do not want to create waves about something that once passed the "code," you can educate the client on the issues and potential hazard. You can explain why the code (or standards) changed and let the client decide. The personal experience with my clothes dryer made an impres
sion on me. It left me with a completely new outlook on the importance of the dryer exhaust system.

Why Exhausting is Critical

Moisture... One gallon or more of water must be disposed of for every typical load of laundry. Because of the moisture, exhausting the dryer to the outside is a must. Indoor exhausting can create conditions that support mold growth and degrade indoor air quality.

Carbon Monoxide... Proper exhausting is of particular importance with gas dryers. In addition to moisture and lint, a gas dryer's exhaust duct
carries the byproducts of combustion, including carbon monoxide.

Clogging... A lot of lint is produced during the drying process, and lint can restrict or block dryer ducts. A poorly exhausting dryer is not only less efficient, it can also be a fire hazard due to the extreme flammability of lint. Clogging can also cause moisture to accumulate and seep out the duct, leading to moisture damage.

Suggestions for Clients

- Have dryer and exhaust ducts inspected and cleaned annually.
- Always follow the dryer manufacturer's recommendations.
- If the exhaust duct system is not up to current standard, have it replaced or corrected.
- It is good practice to always run the dryer long enough so that the last few minutes push only hot, dry air into the duct. This will help to clear out any remaining moisture.
- Install a fire extinguisher in laundry area, but not over the dryer.
- Install smoke alarm in laundry area.
- Install CO alarm in laundry area (Gas dryer only).
- Clean lint filter before every cycle.
- Replace a damaged lint filter.
- Monitor exterior termination for flapper function and airflow.
- Use caution not to crush or kink transition duct behind dryer.
- Never operate a dryer while sleeping or away from home.
- Concerns should be dealt with immediately.

Photos courtesy of John Cranor and ASHI Member Lou Collier.