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The Hazards of Mechanical Energy Utilized in Our Appliances

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Household appliances fail every day. Unfortunately, the ramifications of some failures can include injuries, broken equipment, or fires and explosions. According to the National Fire Protection Association, U.S. fire departments responded to an estimated average of 15,970 home structure fires involving washing machines or clothes dryers each year from 2010-2014, and there were 170,200 home fires involving kitchen equipment each year in a similar four-year period.

Mechanical energy, the energy of motion, has been utilized in common household appliances from the earliest washing machines to modern novelty juicers. The hazards of mechanical energy may defy intuition and are often overlooked. To better understand why mechanical energy plays such an important role when investigating an appliance failure claim, let's look at several basic concepts of mechanical energy in appliances.

ENERGY IN MOTION

The washing machine's spin cycle is an excellent example of mechanical energy and helps to illustrate the important concept that energy cannot instantly disappear. The washing machine has long been considered a potentially hazardous appliance due to its combination of water, electricity and significant mechanical energy. The quest for efficiency has pushed manufacturers to increase spin cycle speed, relying on more sophisticated control systems to keep everything safe. Many investigations have revealed units that operated without incident for years before a sudden catastrophic event occurs. Incidents typically involve significant motion (rocking, walking, and heavy vibration) along with deformation of units, often resulting in water-related losses due to severed water lines and cracked tubs. At the height of an average washing machine spin cycle, the amount of mechanical energy can be equivalent to a 220-300-pound football player running at a speed of 40 yards in four seconds. That energy does not instantly disappear should the washing machine suddenly switch off. Now imagine that football player running full force into the washing machine—there is going to be damage.

Mechanical energy can be dissipated or converted into a form of energy that is no longer useful. Most appliances dissipate mechanical energy through friction (a rubbing action) over a wind-down period. But when an accident occurs, mechanical energy is typically not given the proper amount of time and can dissipate in various unwanted forms: appliance breakage; damage to surroundings; and, unfortunately, injuries. The key takeaway is that the influence of mechanical energy cannot be removed as quickly as turning off a switch.

SMALLER PARTS, GREATER SPEED

Smaller appliances such as blenders and food processers develop their significant mechanical energy from the high-speed rotation of their blades. Mechanical failure of bearings that keep the rotating parts in place can lead to rapid wear and sudden failure. Without much warning, a powerful countertop blender can tear itself apart internally, causing immediate exposure to a stray current or the mixture of liquids and electricity.

Vibration becomes an important factor with regard to handheld appliances such as a stick blender. A sudden onset of significant vibration may cause a user to drop the unit while the exposed blades are spinning.

Appliances that have rotating components, such as garbage disposals, HVAC systems, ceiling fans, and juicers, should have their mechanical energy taken into consideration when investigating an accident, as a primary mechanical failure can lead to a secondary electrical failure, which causes the greatest potential for damage.

HIDDEN MECHANICAL ENERGY

A pressure cooker that explodes due to a faulty pressure relief valve is extreme, but it illustrates the more elusive form of mechanical energy known as potential energy. Nothing is moving, and yet there exists the potential for significant motion.

In many cases pressurized or compressed gas serves as the source of potential energy. A gas, unlike liquid, is compressible and can store an unassuming amount of potential energy in a small space. Appliances can create pressurized gas by using a pump, heating air within an enclosed space (or a combination of both), or utilizing charged cartridges (pressurized CO2) as a source of compressed gas.

Aside from misuse, the leading cause of pressurized gas appliance hazards has been unreliable locks and faulty pressure relief valves. A pressure cooker lock should prevent it from being opened when pressurized, but while standard operating pressure is near that of a soda can, imagine your favorite canned drink spraying on you at a temperature greater than boiling water.

While some incidents of appliance failure only result in a clean-up and/or loss of use, the potential for injuries and significant damage from water, fire, electrical shocks, or explosions does exist in our household appliances. Vigilance is necessary whenever they are being used.

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