

## Incomplete Combustion

Combustion occurs when two or more substances combine with oxygen are heated to the substances ignition point, or kindling temperature, to produce an exothermic reaction referred to as burning. Flame represents this reaction. When a hydrocarbon burns in oxygen, it yields carbon dioxide and water vapor, as well as a limited number of products. Regardless of the substance being burned, the state of complete combustion is almost impossible to achieve.

Incomplete combustion occurs when there is insufficient oxygen to allow a hydrocarbon fuel source to react completely with oxygen to produce carbon dioxide and water. This produces airborne contaminants in the environment consisting of trace by-products and sub-micrometer-size inorganic particulate that was not consumed in the combustion reaction. Combustion sources that burn oil, gas, and wood; such as thermal power plants, automobiles, fireplaces, oil lamps, candles, and smoking materials, are major sources of hydrocarbon, sulfur dioxide, carbon dioxide, nitrogen oxides, soot and ash particulate (incomplete combustion).

Soot is primarily responsible for discoloration of walls, ceilings and floors caused by incomplete combustion, referred to as "ghosting". When carpet is exposed to incomplete combustion by-products, soil filtration lines will develop. Although soil filtration of initially airborne, incomplete combustion by-products occurs throughout a carpet, it is first noticed in areas that disrupt the flow of soils filtrating through a carpet. These areas are located on the floor next to walls, around heat/air exchange vents, at doors and other locations where transition strip is used, and next to upholstered furniture where the skirt touches the carpet. Continued exposure to soot can cause almost all of a carpet to develop a dull gray cast that can permanently alter a carpet's appearance.

To clean carpet dulled by incomplete combustion sources, it is first necessary to discontinue the activities and/or conditions responsible for the occurrence. Once this has been accomplished, the carpet will first require thorough vacuuming without the use of the beater bar and brush attachment, since they can force particulate deep into the carpet's pile. Cleaning should be done by a professional carpet care technician. The use of a select non-chlorinated solvent pre-spray is often required, and it may be necessary to use a Bonnet equipped with a soft cotton head to agitate the carpet's pile to achieve greater penetration of the pre-spray, which is then extracted after ample dwell time. The carpet is then cleaned by hot water-extraction, using a low pH, low foaming detergent, followed by an organic acid rinse using clear water.

Because of the difficulty associated with removing oily soils such as soot from carpeting, carpets soiled by incomplete combustion can require two cleanings. Complete restoration may not be obtained.

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