



Coffee Break Training - Fire Protection Series

Hazardous Materials: Is it a Liquid or a Solid?

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Learning Objective: The student shall be able to describe the test protocols to distinguish between a hazardous materials liquid and solid.

Fire inspectors always are on the lookout for accumulations of flammable or combustible liquids or solids that may contribute to dangerous fire conditions, but how do they determine whether those products are liquids or solids for the purpose of applying fire safety regulations?

The product in the illustration is a hydrocarbon-based lubricant with a flash point of 515 F (268 C) that if it could flow would qualify it as a Class IIIB combustible liquid, but is it a liquid or solid?

National Fire Protection Association 30, *Flammable and Combustible Liquids Code*, defines a **liquid** as any material that 1) has a fluidity greater than that of 300 penetration asphalt when tested in accordance with American Society for Testing and Materials D 5, *Standard Test Method for Penetration of Bituminous Materials*, or 2) is a viscous substance for which a specific melting point cannot be determined but that is determined to be a liquid in accordance with ASTM D 4359, *Standard Test for Determining Whether a Material is a Liquid or a Solid*.

In the ASTM D 5 test, a standard penetration test apparatus (called a penetrometer) is used to plunge a needle that measures 2 inches long by 50.8 millimeters length by 1 mm diameter into a heated, liquefied sample of the product being evaluated. This test generally is used to measure the viscosity of asphalt. The product is heated to 77 F (25 C) and then allowed to cool for one to one and one-half hours. The depth of penetration over a five second test is measured in units of 0.1 mm and is reported as penetration units. So if the needle penetrates 0.8 mm, the penetration of asphalt is 80. Lower numbers represent stiffer materials, so a “300 penetration asphalt” is a more fluid product than one with a smaller number.

The alternative test, ASTM D 4359, employs a closed vessel in which the product to be tested is heated to 100 F (38 C) and then inverted. If there is no detectable flow, the product is classified as a solid.

While this may seem to be only an academic exercise when it comes to thick products like lubricants, it does have real world implications. A hydrocarbon product that routinely may appear to be a solid might liquefy and flow — as well as emit combustible vapors — above 100 F (38 C) when exposed to a fire or stored in a confined environment when the ambient temperature might exceed 100 F (38 C). The fire inspector should evaluate the potential consequences of these changes in the physical state of the material.



This hydrocarbon-based lubricating product generally appears to be a viscous solid but under some conditions may be classified as a combustible liquid.



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