Restrictions required by the listing of a less-flammable liquid are illustrated by the use of an FM Approvals LLC–approved liquid in a transformer tank. Pressure-relief devices must be provided. Spacing from adjacent buildings or transformers must also be provided. The spacing, as illustrated in Exhibit 450.13, is based not only on the fluid capacity of the transformer tank but also on the listing of the transformer and the building construction. In the event of a leak, the liquid confinement area prevents transformer dielectric fluid from spreading beyond the vicinity of the transformer. Further information on applications may be found in the Factory Mutual Loss Prevention Data Sheet 5-4.

The requirements in 450.23 refer to buildings of Types I and II construction. Table E.1 in Informative Annex E is a summary of the requirements for construction types. The Arabic numerals at the top of the fire resistance rating columns reflect the fire resistance ratings of the following building elements: exterior bearing walls; columns, beams, girders, trusses and arches, support bearing walls, columns, or loads from more than one floor; and the floor construction.

For example, a building of Type I, 442 construction has 4-hour fire-resistance-rated exterior bearing walls; 4-hour fire-resistance-rated columns, beams, girders, trusses, or arches; and 3-hour fire-resistance-rated floor construction. Whether a building is of Type I, Type II, or other type is determined by the requirements of the building construction code adopted by a jurisdiction.

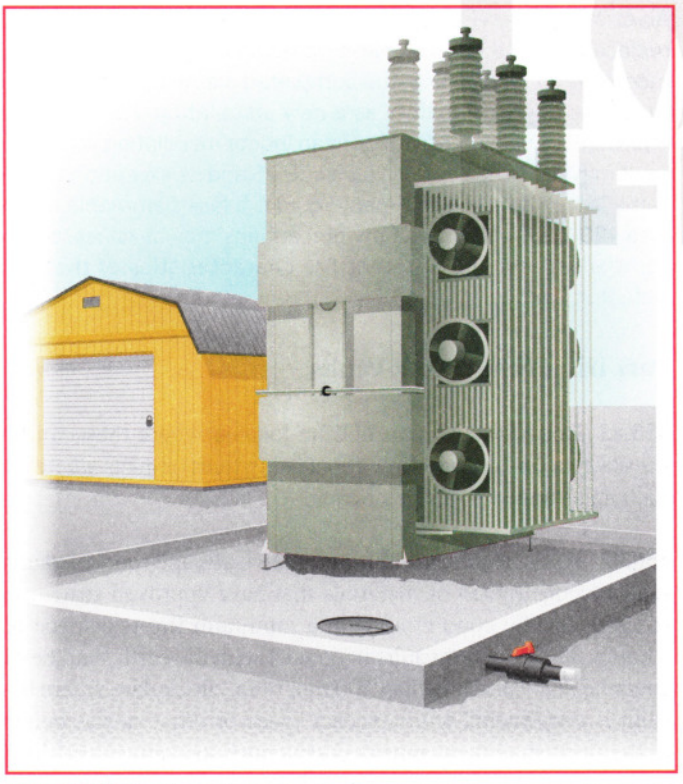

EXHIBIT 450.13 A transformer tank containing a less-flammable fluid listed by FM Approvals, where the spacing from adjacent combustibles to the liquid confinement area is based on the capacity of the tank.

450.24 Nonflammable Fluid-Insulated Transformers. Transformers insulated with a dielectric fluid identified as nonflammable shall be permitted to be installed indoors or outdoors. Such transformers installed indoors and rated over 35,000 volts shall be installed in a vault. Such transformers installed indoors shall be furnished with a liquid confinement area and a pressure-relief vent. The transformers shall be furnished with a means for absorbing any gases generated by arcing inside the tank, or the pressure-relief vent shall be connected to a chimney or flue that will carry such gases to an environmentally safe area.

Informational Note: Safety may be increased if fire hazard analyses are performed for such transformer installations.

For the purposes of this section, a nonflammable dielectric fluid is one that does not have a flash point or fire point and is not flammable in air.

A liquid confinement area and a pressure-relief vent are required for nonflammable-fluid-insulated transformers. The liquid confinement area limits the extent of a spill if the tank leaks or ruptures. If a means for absorbing gases generated by arcing within the transformer is not provided, the pressure-relief vent must be connected to a chimney or flue that vents to an environmentally safe area.

The need for a gas absorption system or a chimney or flue that vents to an environmentally safe area is due to concerns about products generated during arcing. The high arc temperatures can cause the insulating medium to break down, resulting in the formation and emission of toxic or corrosive compounds.

450.25 Askarel-Insulated Transformers Installed Indoors. Askarel-insulated transformers installed indoors and rated over 25 kVA shall be furnished with a pressure-relief vent. Where installed in a poorly ventilated place, they shall be furnished with a means for absorbing any gases generated by arcing inside the case, or the pressure-relief vent shall be connected to a chimney or flue that carries such gases outside the building. Askarel-insulated transformers rated over 35,000 volts shall be installed in a vault.

Askarel-insulated transformers are no longer manufactured because askarel has been classified as a carcinogen. Very few askarel transformers are in use today. Transformers could be labeled as "PCB Transformer" without having the fire resistance properties of an askarel transformer. That is because federal regulations classify a transformer as a PCB (polychlorinated biphenyls) transformer if it contains 500 parts or more per million PCBs. In the past, transformer liquids could become contaminated with PCBs because the insulating liquid had been temporarily stored in a tank that had previously contained askarel. The information provided in the *NEC*® is for reference and for the modification of existing askarel-insulated installations. Existing askarel-insulated transformers of 35,000 volts or less are not