The classification of solvents and the listing of equipment by Underwriters Laboratories (UL) involve specific tests with specific objectives.

Safety Standards for Solvents and Systems

BY STEVEN M. PRISBY

Today, safety is everyone's concern. The classification of flammable and nonflammable solvents and the proper evaluation and use of parts cleaners and solvent recovery equipment help provide protection for a corporation's personnel, equipment, and the environment.

Underwriters Laboratories (UL) offers listing and follow-up service for parts cleaners and solvent recovery equipment as well as classification of nonflammable and flammable liquids.

Parts Cleaners

UL defines parts cleaners as stationary units intended for use with cleaning liquids, combustible solvents, and water-based cleaning solutions.

Listed parts cleaners for use in hazardous (classified) locations shall comply with at least the requirements for use in a Class 1, Div. 2 area. These are locations where, during unusual conditions such as accidental rupture of a container or failure of mechanical ventilation, a flammable gas or vapor is likely to be present in the atmosphere.

Listed parts cleaners are intended only for use with fluids that have been classified by UL, marked on the unit, with fire hazard classification of not greater than 40 and a flash point not less than 100°F. The physiological effects of the solvent, in any form, have not been investigated by UL and are not covered by the listing.

There is no published standard for the evaluation of parts cleaners. However, UL developed an appropriate test program over 20 years ago, involving examination of the product with respect to electric shock, fire, and casualty hazards. A product complying with the test requirements and constructed of listed or recognized component electrical equipment is eligible for listing and follow-up service.

Parts cleaners are covered under the category of Parts Cleaners (QGDS) in the Gas and Oil Equipment Directory. Parts cleaners for use in hazardous locations are covered under the category of Parts Cleaners for Use in Hazardous Locations (QKKR) in the Hazardous Locations Directory.

Test Program

Explosivity *Tests* are conducted to determine if, during normal operation of the parts cleaner at ambient room and solvent temperatures, the device does not produce an explosive vapor-air mixture.

Input Test determines that the recorded inputs do not exceed the marked electrical ratings during normal operation,

Blocked Outlet and External Leakage *Tests* determine if there is leakage at the motor shaft seal at an elevated pressure.

Endurance Test is conducted for 300 h at normal room ambient. The parts cleaner must operate as intended without malfunction.

Gasket Tests determine the integrity of each gasket material after various exposures. Volume changes and extraction tests are conducted before and after immersion in ASTM Fuel C for 70 h. Also, a visual examination is conducted after accelerated oxygen-pressure aging.

Locked Rotor Test in Air determines if maximum internal temperatures of the motor under locked rotor conditions exceed its rated temperature.

Locked Rotor Test in the Presence of Gasoline *Vapor-Air Mixture* determines if maximum internal temperature of the motor under locked rotor conditions will not ignite the gasoline vapor-air mixtures in the test chamber surrounding the motor.

Tests for Generation and Accumulation of Static Electrical Charges determine if the external polymeric motor enclosure is sufficiently conductive and/or grounded to minimize ignition of an explosive atmosphere resulting from the discharge of static electricity.

Test for Static Sparks is conducted on external polymeric parts of the motor assembly after they have been conditioned in a low-humidity room. After conditioning, the electrostatic discharge from a Van de Graff generator is applied to the motor housing and observed for sparks passing between the housing and generator.

Fusible *Link Operation Test* determines if the fusible link will operate and close the parts cleaner lid within a reasonable amount of time. It also assesses the fusible link's operating temperature.

Clogged Drain Test determines if the overflow device operates as intended when the drain is clogged.

Stability Test determines if the support structure is adequate when the sink is filled to maximum depth as determined by the Clogged Drain Test with and without additional weights in the sink.

Closure Test determines if the lid can be closed when the lamp or spray hose is positioned in the most unfavorable conditions.

Lamp Surface Temperature Test determines if, during nor

mal operation of the parts cleaner, external surface temperatures on the lamp shield pose a burn hazard to the user.

Solvent Recovery Equipment

Solvent recovery equipment is designed to reclaim clean solvent — both flammable and nonflammable — from solvent that has been contaminated in cleaning, degreasing, and other industrial processes. A typical solvent recovery unit consists of a boiler, a condenser, and the necessary control equipment.

After contaminated solvent poured into the unit is heated to its boiling point, vapors are collected and condensed, resulting in clean liquid solvent contained in a drum. When the cycle has been completed and the unit has cooled, the residue is collected and disposed of.

The test program for solvent recovery equipment evaluates the product in all aspects of electric shock, fire, explosion, and casualty hazards. A product complying with the construction and performance requirements outlined in the standards is eligible for listing and follow-up service.

The test program for solvent recovery equipment depends on a unit's specific protection provisions. In addition, various ordinary location standards could be applicable. Following are some typical UL standards used for evaluation of this type of equipment:

- Standard for Electric Heating Appliances, UL 499
- Standard for Industrial Control Equipment for Use in Hazardous (Classified) Locations, UL 698
- Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, Div. 1 Hazardous (Classified) Locations, UL 913

UL also provides listing and follow-up service for solvent recovery equipment for use in hazardous [classified) locations. Since this type of equipment handles material above its flash point, the equipment shall comply with the requirements for a Class I, Div. 1 area. This is a location where, during normal operation of the equipment, a flammable gas or vapor is present or likely to be present in the atmosphere.

The manufacturer shall indicate the Hazardous Location classes and groups as well as the specific materials for which the equipment is intended. A typical test program for a solvent recovery unit for use in Class I, Group D hazardous locations follows.

Test Program

Input Test determines if, during normal operation of the solvent recovery unit, the recorded inputs do not exceed the marked electrical ratings.

Normal Temperature Test determines if, during normal operation, the maximum temperatures of all components do not exceed their rated temperatures.

Abnormal *Temperature Test* determines the maximum surface temperature of the unit with all thermostats shunted out of the circuits. The unit is operated until thermal equilibrium or activation of limit control. Maximum temperature attained cannot exceed the ignition temperature of the solvents specified by the manufacturer.

Normal *Operation Test* determines if the unit will operate as intended without the limit control operating.

Abnormal Operation Test determines if

a loss of air, water, or of the thermostat controls would cause user-accessible parts to exceed their safe temperatures or other safety-related concerns.

Dielectric Voltage-Withstand Test determines if the insulation materials are adequate.

Solvent Vapor Exposure Test on Boiler Gaskets determines the integrity of each gasket material after at least 28 days of exposure to solvent vapors. Vol**ume change, tensile strength, and elongation tests are conducted before** and after exposure.

Test for Accumulation of Static Electricity is conducted on all external polymeric materials. After three samples of each material have been conditioned in a low-humidity room, the electrostatic discharge from a Van de Graff generator is applied to each material and observed for sparks passing between the material and generator.

Hydrostatic Pressure Strength Test on Pressure-Containing Parts determines if the pressure-containing components have adequate mechanical strength.

Explosion and Hydrostatic Pressure Strength Tests on Explosion-Proof Enclosures are conducted on all explosion-proof enclosures using the appropriate test gas for the intended application. The Hydrostatic Pressure Strength Tests determine if the explosion-proof enclosures have adequate mechanical strength with a safety factor of four.

Tests for Intrinsic Safety determine if electrical components which are not explosion-proof can be intrinsically safe. Such circuits are those which any spark or thermal effect, produced either normally or under a fault condition, is incapable of igniting the most easily ignitable concentration of flammable or combustible material in mixture with air.

Classification of Fluids

UL classifies fluids for use with parts cleaners and other industrial applications. covered under the category of Cleaning Liquids (DQXV) in the Gas and Oil Equipment Directory.

UL classifies solvents as nonflammable, or as flammable with a degree of fire hazard rated both in general terms and on a numerical scale, in comparison to well-known products with hazards established by field experience. The classifications are as follows:

General Classification	Numerical Classification
Diethyl ether class	100-110
Gasoline class	90-100
Ethyl alcohol class	60-70
Kerosene class	30-40
Paraffin oil class	10-20

In addition to the numerical scale for flammability, the test program for classification of fluids covers flash point, ignition temperature, spontaneous heating and burning potential. The stand used to evaluate and classify fluids r liquids is the Standard for Test for Comparative Flammability of Liquids UL 340. ❑

About the Author

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