



GUIDE
FOR
THE INVESTIGATION
OF
INTERNAL COMBUSTION
ENGINE-POWERED INDUSTRIAL TRUCKS

UNDERWRITERS' LABORATORIES OF CANADA

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Please Refer to ULC Subject C558-1975

GUIDE FOR THE INVESTIGATION OF INTERNAL COMBUSTION ENGINE-POWERED INDUSTRIAL TRUCKS

GENERAL

1. Scope

1.1 These requirements cover the fire-hazard aspects of industrial trucks with internal-combustion engines, such as tractors, platform-lift trucks, fork-lift trucks, and other specialized vehicles for industrial use. These requirements do not cover other possible hazard aspects of such equipment.

1.2 These requirements do not cover farm or road vehicles or automotive vehicles for highway use.

1.3 Internal-combustion engine-powered industrial trucks covered by these requirements are identified as follows:

Types G, D, and LP - Trucks fueled with gasoline (G), diesel fuel (D), or liquefied petroleum gas (LP), having fuel, electrical, and exhaust systems provided with minimum acceptable safeguards against fire hazards.

Types GS, DS, and LPS - Trucks fueled with gasoline (GS), diesel fuel (DS), or liquefied petroleum gas (LPS), provided with safeguards in addition to those required for Types G, D, and LP, respectively.

1.4 Other reference standards applying to power-operated industrial trucks are as follows:

ANSI B56.1-1969. Powered Industrial Trucks, Safety Standard for (Requirements relating to the elements of design, operation, and maintenance of powered-industrial trucks).

ANSI B56.2-1971. Powered Industrial Trucks, Type Designations, Areas of Use, Maintenance, and Operation, NFPA No. 505-1973. (Relates to a classification of industrial trucks as to areas of use, maintenance, and operation).

Electric-Battery-Powered Industrial Trucks, ULC Subject C583-1974.
(Requirements relating to fire, electric shock, and explosion hazards).

2. Components

2.1 A component of an industrial truck shall comply with the requirements, as noted herein, for that component, except that such requirements may be modified if appropriate for the particular application.

3. Samples

3.1 Unless otherwise expressly stated herein the performance of an industrial truck shall be satisfied by the testing of a representative model of a new vehicle.

CONSTRUCTION - TYPES G, D, AND LP

4. ELECTRICAL SYSTEMS

4.1 Wires and cables shall be installed so as to minimize chafing of insulation. Acceptable provisions may include the use of clamps, grommets, loom, sleeves, supplementary insulation, conduit, and routing.

4.2 Wiring mounted on booms, lifts, and similar parts subject to motion relative to other parts to which the wiring is connected, shall not be subject to damage or failure as the result of bending, kinking, abrasion, etc.

4.3 Wiring and cables shall be installed with means for maintaining clearance from moving parts, hot engine parts, exhaust systems, and fuel systems and shall not be supported on surfaces that may be subjected to accumulation of oil or grease as a result of normal servicing.

4.4 Wiring and cables shall not be exposed to drippage of fuel, oil, or grease and shall not be supported on oil- or grease-retaining surfaces.

4.5 Electrical wiring and cables shall be equivalent to material conforming with the Standard for Low-Tension Cable, SAE J558a-1968, Type GPT, having a minimum conductor size equivalent to No. 16 AWG.

4.6 If an audible electrical warning device is employed, its coil and other electrical parts shall be enclosed in metal, or by an equivalent material. Among the factors which shall be taken into consideration when judging the equivalency of a nonmetallic enclosure are (1) the mechanical strength, (2) resistance to impact, (3) moisture-absorptive properties, (4) combustibility, and (5) resistance to distortion at temperatures to which the material may be subjected under conditions of normal or abnormal usage.

4.7 Each lighting- and warning-device circuit shall be protected by a fuse or a circuit breaker rated to protect against hazard due to short or grounded circuit. A fuse conforming with the Standard for Electric Fuses, SAE J554-1965 shall be considered acceptable.

5. Exhaust Systems

5.1 The exhaust system, beyond the manifold, shall be supported at least 3 inches clear of combustible materials, excluding flexible mountings, and at least 2 inches clear of fuel- and electrical-system parts and shall not be subject to dripage of fuel, oil, or grease. Also see Section 11.

5.2 A muffler shall be provided and shall conform with the test requirements of Section 14.

6. Fuel Systems - Gasoline and Diesel

Tanks and Pumps

6.1 A fuel tank shall be constructed of painted mild steel having a minimum thickness of 0.032 inch (No. 20 MSG) or material equivalent in strength, rigidity, and resistance to fire and corrosion. The joints shall be welded, brazed, soldered, or bonded. If soldered or bonded, the joints shall be of a construction which will retain the heads if the solder or bonding melts. Fittings and fill pipe, if soldered or bonded, shall be mechanically secured to the tank in addition to soldering or bonding.

6.2 A fuel tank shall not be located directly over the engine. If a tank is within or contiguous to the engine compartment, the tank and/or fill arrangement shall be isolated from the electrical and exhaust systems by a separate enclosure or by baffles. The tank location and the facilities for filling shall be such that spillage or leakage will drain to the ground and not into the engine compartment or onto electrical- or exhaust-system parts. Spillage tests shall be conducted if necessary to determine compliance with the intent of the foregoing requirements. See also Clause 11.1.

6.3 A fuel tank and fill fitting shall be so located as to minimize the possibility of damage to the tank or its fittings.

6.4 External fuel-confining parts of an electrically or mechanically operated fuel pump shall be of metal. Failure of operating parts shall not result in external leakage of fuel.

6.5 A shut-off valve shall be provided in an accessible location near the tank on gravity-feed systems or on systems where the contents of the tank may discharge by siphon action if the fuel line breaks.

Fuel Lines and Fittings

6.6 Fuel lines, except those used in a high-pressure injection system, shall be of seamless annealed copper or steel tubing. Flexible tubing or hose shall be used where necessary to absorb vibration.

6.7 Copper tubing shall have a nominal wall thickness of not less than 0.035 inch (0.003-inch minus tolerance). Steel tubing shall have a wall thickness of not less than 0.028 inch and shall have a corrosion-resistant exterior coating equivalent to that afforded by paint.

6.8 High-pressure injection tubing shall conform with the Standard for Fuel Injection Tubing, SAE J521a-1970. Flexible tubing or hose shall conform with the Standard for Fuel and Oil Hose, SAE J30a-1970.

6.9 Low-pressure fuel-line fittings shall be of the flare type conforming to the Standard for Automotive Fittings, SAE J512e-1969, or the Standard for Fittings for Flared Copper Tubes, ANSI B16.26-1967. The details for connections to valves or drain cocks shall conform to the Standard for Automotive Fittings SAE J512e-1969, or the equivalent. High-pressure injection fuel-line fittings shall conform with the Standard for Fuel Injection Connections, SAE J521a-1970.

6.10 A body or fitting provided with tapered threads shall be threaded in accordance with the Standard for Pipe Threads, ANSI B2.1-1968.

6.11 External fuel-confining parts of a filter, except a gasket or seal, shall be of metal. The assembly shall conform with the requirements of Clause 20.3.

6.12 Fuel lines shall be supported to minimize chafing and to maintain at least a 2-inch clearance from exhaust- and electrical-system parts.

6.13 Fuel feed lines, valves, and fittings shall be located so that any leakage will not run off or drip on electrical- or exhaust-system parts.

Nonmetallic Parts

6.14 A synthetic-rubber part in contact with gasoline or diesel fuel shall not show excessive volume change or loss of weight, when considered on the basis of its intended function, following immersion for 70 hours in the test liquid specified in Table 1.

T A B L E 1

TEST LIQUIDS FOR NONMETALLIC MATERIALS

Liquid in Contact with Part	Test Liquid
Gasoline	ASTM Reference Fuels A and C
Diesel Oil	ASTM Swelling Oils 1 and 3

6.15 A change in volume of not more than 25 per cent swelling or 5 per cent shrinkage, and a weight loss (extraction) of not more than 10 per cent is considered as indicating compliance with Clause 6.14.

6.16 A part made of synthetic rubber which may be affected by aging shall not crack or show visible evidence of deterioration following exposure for 96 hours to oxygen at a pressure of 300 pounds per square inch (PSI) and a temperature of 158°F.

Corrosion Resistance

6.17 If corrosion of a ferrous part will interfere with the proper functioning of a part, the part shall be provided with a corrosion-resistant protective coating.

6.18 A part made of drawn brass or machined from brass rod shall be capable of withstanding, without cracking, the Mercurous-Nitrate Test for copper and copper alloys. See Section 23.

Carburetors

6.19 An updraft carburetor, if used, shall be located so that overflow of gasoline due to excess choking will flow to ground and not contact electrical parts and exhaust system, or collect in an engine compartment. Nonmetallic drain hose, if used, shall comply with the fuel resistance, oil resistance, and dry-heat resistance tests of the Standard for Fuel and Oil Hose, SAE J30a-1970.

6.20 A downdraft carburetor, if used, having an external float bowl vent opening, shall have a vent overflow tube to direct fuel away from the engine in case of fuel overflow.

6.21 A backfire deflector shall be provided on each combustion air intake and, whether separate or a part of an air cleaner, shall conform with the requirements of Clause 13.1.

7. Fuel Systems - Liquefied Petroleum Gas

General

7.1 Each vehicle shall have the complete fuel system installed at the factory, except as indicated in Clause 7.2.

7.2 Vehicles equipped to use a removable fuel container may be shipped without the fuel container if a metal nameplate that identifies the correct fuel-container assembly to be used is attached adjacent to the container-mounting hardware.

7.3 Nonductile (regular grey iron) cast iron shall not be used for LP-Gas confining parts.

7.4 A body or fitting provided with tapered threads shall be threaded in accordance with the Standard for Pipe Threads, ANSI B2.1-1968.

7.5 Vaporizers, regulators, valves, filters, and other fuel-system components shall be of a type designed for use with LP-Gas at a working pressure not less than 250 pounds per square inch gauge.

7.6 Valves and connections on containers shall be protected to minimize the possibility of damage due to accidental contact with stationary objects or from loose objects thrown up from the road. Valves shall be protected to minimize the possibility of damage due to collision, overturning, or other accident. Parts of the vehicle may be used to provide such protection to valves and fittings.

7.7 All fuel-system components shall be fastened to the vehicle to minimize the possibility of loosening due to vibration.

Containers

7.8 A fuel container shall be a pressure vessel constructed, tested, and marked in accordance with (1) the ASME Unfired Pressure Vessel Code or (2) the Specification of the Canadian Transport Commission (CTC) for LP-Gas Containers.

7.9 A fuel container may be fixed to or removable from the vehicle.

7.10 An ASME Fuel container shall have a design working pressure of 312 pounds per square inch gauge, 343 pounds per square inch gauge, or 375 pounds per square inch gauge. It shall be marked with the ASME "U" symbol and the design working pressure.

7.11 A CTC fuel container shall be constructed, tested, and marked for a minimum service pressure of 240 pounds per square inch gauge. It shall bear the marking CTC-4B240, CTC-4BA240, CTC-4BW240, or CTC-4E240.

7.12 A fuel container shall be so located as to minimize the possibility of damage to the container or its fittings. The fittings of a removable container shall be protected to minimize the possibility of damage during removal, filling, and replacement. A container and its fittings shall not extend beyond the plan form of the vehicle.

7.13 A fuel container shall be installed with as much ground clearance as practical, but never less than the minimum road clearance of the vehicle in the area of the fuel container. This minimum clearance shall be measured to the bottom of the container or to the lowest fitting.

7.14 A fuel container shall be secured in place on the vehicle so as to meet the requirements of a loading test. See Clause 16.1.