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ULC/ORD-C107.12-1992

LINE LEAK
DETECTION DEVICES
FOR FLAMMABLE
LIQUID PIPING



Underwriters' Laboratories of Canada



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**LINE LEAK DETECTION DEVICES
FOR FLAMMABLE LIQUID PIPING**

Prepared and Published by
UNDERWRITERS' LABORATORIES OF CANADA



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FOREWORD

Certification organizations are periodically called upon to respond promptly to a need to provide a certification service for devices, constructions, materials and systems for which no recognized standards of acceptance are available. Accordingly, the certification agency draws upon its experience, existing specifications and requirements in related areas, together with assistance from its advisory councils to develop and prepare an "Other Recognized Document" (ORD) for use in conducting the necessary tests and evaluation investigation.

Underwriters' Laboratories of Canada has over the years prepared many ORD's in response to requests from, and in conjunction with, industry, code writing bodies, regulatory agencies and others prior to inaugurating a certification programme. In many instances such documents have become published ULC Standards and subsequently National Standards of Canada. It is the intention of Underwriters' Laboratories of Canada to continue this practice, as appropriate.

Comments on the content of this ORD should be directed to the Head Office of Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario, CANADA, M1R 3A9.

NOTE: These Recognized Documents are accepted under the National Standards System of Canada. Reference may be made to the Document CAN-P-3, "Criteria and Procedures for Accreditation of Certification Organization" published by the Standards Council of Canada located at 45 O'Connor Street, Suite 1200, Ottawa, Ontario, CANADA, K1P 6N7.



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In Replying
Please Refer to

ULC/ORD-C107.12-1992

LINE LEAK DETECTION DEVICES FOR FLAMMABLE LIQUID PIPING

PREFACE

This is the First Edition of ULC/ORD-C107.12-1992, entitled "Line Leak Detection Devices For Flammable Liquid Piping".

A product which complies with these requirements will not necessarily be acceptable if, when examined and tested, it is found to have features not covered by this document which may impair the result contemplated by these requirements.

A product employing materials or having forms of construction differing from those detailed in these requirements may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be given recognition.

Units of measurement used in this document are Metric SI.

1. SCOPE

1.1 These requirements cover equipment for the detection of leakage from underground flammable liquid pipeline systems by directly or indirectly measuring changes in the volume or pressure of the liquid in the system over a period of time.

1.2 These requirements provide for the determination of the capability of equipment for the measurement of actual or potential leakage rates within defined statistical probabilities.

1.3 These requirements do not cover non-volumetric leak detection equipment or methods.

2. GENERAL

2.1 A component of a product covered by this document shall comply with the requirements for that component, and shall be used in accordance with its recognized rating and other limitations of use.

2.2 A component need not comply with a specific requirement that involves a feature or characteristic not needed in the application of the component in the product covered or superseded by a requirement in this document.

3. MATERIALS, WORKMANSHIP AND CONSTRUCTION

3.1 GENERAL

3.1.1 The materials, workmanship, and construction shall be such as to provide continued operation of the equipment over an extended period of time under the conditions expected to be met in the environment for which the equipment is designed.

3.2 ELECTRICAL FEATURES

3.2.1 General

3.2.1.1 The electrical features shall meet the applicable requirements of CSA Standard C22.2 No. 142, Process Control Equipment.

3.2.2 Hazardous Areas

3.2.2.1 All assemblies containing electrical equipment or electrical components which are to be used in a hazardous area will either be examined and tested to determine that they are intrinsically safe for use in the specific hazardous area or shall be encased in appropriate explosion proof enclosures. Unenclosed electrical equipment shall be capable of

meeting the requirements of CSA Standard C22.2 No. 157, Intrinsically-Safe and Non-Incendive Circuits for Use in Hazardous Locations. Electrical equipment not meeting the foregoing Standard shall be protected in enclosures meeting the requirements of CSA Hazardous Locations. Such electrical equipment or components shall meet the requirements of the appropriate CSA Standards for electrical safety and performance.

3.3 NONMETALLIC MATERIALS

3.3.1 Nonmetallic materials, which will be subjected to immersion in, or exposure to, flammable or combustible liquids, or their vapours, shall have such characteristics that their properties will not be affected by such liquids or vapours in such a manner as to cause a failure of the equipment or a hazardous condition to occur during the normal expected life of the equipment.

3.4 SERVICE CONDITIONS

3.4.1 The equipment shall operate reliably under the normally anticipated conditions of humidity and temperature and when subjected to jarring and vibration.

3.5 CORROSION PROTECTION

3.5.1 Iron and steel parts, other than bearings, or similar components, where such protection is impracticable, shall be protected against corrosion by enamelling, galvanizing, sherardizing, plating, or equivalent means.

Exception No. 1: This requirement does not apply to parts, such as washers, screws and bolts, if failure of such unprotected parts would not impair the intended operation of the unit.

Exception No. 2: Parts made of stainless steel.

3.5.2 The requirement of Clause 3.5.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation or construction may depend. Bearing surfaces shall be of such materials and design or be continuously lubricated, so as to resist binding due to corrosion.

3.5.3 Differing metals shall not be used in combinations that may result in detrimental galvanic action.

4. OPERATIONAL REQUIREMENTS

4.1 AUTOMATIC ON STREAM LINE LEAK DETECTION CRITERIA

4.1.1 The equipment shall be capable of measuring an 11.4 L/h or greater leak rate, at a line pressure of 69 kPa, with a probability of detection of 0.95 and a probability of false alarm of 0.05 within 1 h of the occurrence of the start of the leak.

4.2 LINE TIGHTNESS DETECTION CRITERIA

4.2.1 The equipment shall be capable of measuring 0.8 L/h or greater leak rate at a line pressure of 206 kPa with a probability of detection of 0.95 and a probability of false alarm of 0.05 within 24 h of the start of the leak test.

4.3 LINE PRECISION LEAK DETECTION CRITERIA

4.3.1 The equipment shall be capable of detecting a leak rate of 0.4 L/h at a line pressure of 310 kPa within a period of 24 h from the start of the test with a probability of detection of 0.95 and a probability of false alarm of 0.05.

Note: For an explanation of the inherent difficulties of precisely determining the operational characteristics and an explanation of the statistical terms and procedures used in this document, see Appendix A.

5. FUNCTIONAL TESTS

5.1 GENERAL

5.1.1 Representative samples that are fully representative of a series of devices of similar design, and construction, shall be submitted for test.

5.2 MATERIAL TESTS

5.2.1 Accelerated Aging Test

5.2.1.1 Representative samples of elastomeric materials which may be in contact with the flammable or combustible liquids or their vapours shall be subjected to an accelerated oxygen pressure aging test for 96 h in oxygen at a temperature of 70°C and at a pressure of 200 kPa. The samples shall be subjected to tensile and hardness determination before and after the aging.

5.2.1.2 The samples shall retain not less than 75% of their original properties after the aging.

5.2.2 Immersion Test

5.2.2.1 Representative samples of non-metallic materials which may be in contact with the flammable or combustible liquids or their vapours shall be immersed for 70 h in ASTM Reference Fuel B*, Reference Fuel C* and ASTM Oil No. 3. The samples and test fluids shall be at a temperature of $23^{\circ}\text{C} \pm 2^{\circ}$. The volume, initially and at the conclusion of the immersion tests shall be determined by the water displacement method, and the percentage change in volume calculated. The amount extracted shall be recorded from the immersion in ASTM Reference Fuel C.

5.2.2.2 The materials shall not show a volume change exceeding 1% shrinkage, or 25% swelling, or an extraction greater than 10%.

*Note: ASTM Reference Fuel B (70 volumes iso-octane, 30 volumes toluene)

ASTM Reference Fuel C (equal volumes of iso-octane and toluene)

5.3 ASSEMBLY TESTS

5.3.1 External Leakage Test

5.3.1.1 Samples of the assemblies or components subject to liquid or vapour pressure shall be leak tested using nitrogen at a pressure of 690 kPa. The samples shall withstand the applied pressure without leakage.

5.3.2 Hydrostatic Strength Test

5.3.2.1 Samples of assemblies or components subject to liquid or vapour pressure shall be subjected to a hydrostatic pressure of 350 kPa for 1 min.

5.3.2.2 The samples shall withstand the applied test pressure without rupture.

5.3.3 Humidity

5.3.3.1 Electrically operated components or assemblies in the de-energized state, shall be subjected to air having a relative humidity of $93\% \pm 2\%$ for 24 h. Following this exposure, the component or assembly shall be removed from the humidity chamber and, within 5 min, be subjected to and meet voltage-withstand test potentials as follows:

- A For a unit with circuits at 30 V rms (42.4 V dc or ac peak) or less - 500 V (707 V, if a dc potential is used); or

- B** For a unit with circuits at more than 30 V rms (42.4 V dc or ac peak) - 1000 V (1414 V, if a dc potential is used) plus twice the circuit voltage.

5.3.3.2 The test potentials shall be applied between:

- A** Live parts and the enclosure;
- B** Live parts and exposed dead metal parts; and
- C** Live parts of circuits operating at different potentials or frequencies.

5.3.4 Jarring

5.3.4.1 Assemblies shall withstand jarring resulting from impact anticipated in the intended application without dislodgement of any parts, including covers or lenses, and without impairing their subsequent intended operation.

5.3.4.2 One impact is to be applied with the assembly de-energized and one impact is to be applied with the assembly operating at rated power input. An assembly intended for wall or ceiling mounting shall be tested in the wall mounted or suspended position.

5.3.4.3 The assembly shall be mounted in the position of intended use to the centre of an 1800 mm by 1200 mm by 19 mm thick plywood board which is secured in place at the four corners. A 100 mm by 100 mm square steel plate, 3.2 mm thick, shall be rigidly secured to the centre of the reverse side of the board. A 1.5 J impact is to be applied to the centre of the steel plate by means of a 535 g, 50 mm diameter steel sphere either:

- A** Swung through a pendulum arc from a height (h) of 286 mm in order to apply 1.5 J of energy; or
- B** Dropped from a height (h) of 286 mm to apply 1.5 J of energy depending upon the mounting of the equipment.

5.3.4.4 Following the jarring, the assembly shall be examined for dislodgement of parts and then subjected to the Vibration Test.

5.3.5 Vibration

5.3.5.1 The sample used in the jarring test, in the de-energized state, shall be mounted as in normal service to a 19 mm thick fir plywood sheet, 460 mm by 460 mm, which, in turn, shall be securely fastened to a variable speed vibration machine having an amplitude of 0.25 mm. The frequency of vibration shall be varied from 5 Hz to 35 Hz until a resonant frequency is obtained. The sample shall then be vibrated at the resonant frequency for 15 min. If no resonant frequency is obtained, the sample shall be vibrated at 35 Hz for 30 min.