

A2L Refrigerant Enclosure Test Machine

IEC 60335-2-40 Flame Propagation Test Equipment for Mildly Flammable Refrigerants



Standards: IEC 60335-2-40:2022, GB/T 4706.32-2024 (A2L refrigerant appliance safety)

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1. Product Overview

The KingPo A2L Refrigerant Enclosure Test Machine is used to assess whether the enclosure of an appliance can prevent flame propagation when an A2L refrigerant leaks and comes into contact with an ignition source. The test simulates refrigerant leakage inside the appliance and applies a controlled spark to evaluate the flame-retardant performance of the enclosure.

It helps manufacturers verify that their products meet the safety requirements of IEC 60335-2-40:2022 when using mildly flammable A2L refrigerants. It is particularly important for appliances such as room air conditioners, heat pumps, and dehumidifiers. The machine features an explosion-proof simulated environment chamber specifically designed for safe testing of refrigerant leakage and ignition scenarios.

2. Applicable Standards

- **IEC 60335-2-40:2022** — Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers (A2L refrigerant requirements)
- **GB/T 4706.32-2024** — Corresponding Chinese national standard for safety of electrical heat pumps, air-conditioners and dehumidifiers

3. Test Purpose

This test machine simulates the scenario where an A2L refrigerant leaks inside an appliance and is ignited by an internal or external ignition source. A controlled high-voltage spark is generated at an adjustable electrode gap to ignite the leaked refrigerant-air mixture. The test then observes whether the flame propagates outside the enclosure or remains contained.

By controlling the spark gap, voltage, discharge time, and environmental conditions, the equipment provides a repeatable method to evaluate the flame-retardant effectiveness of the appliance enclosure, ensuring safety compliance for products using mildly flammable refrigerants such as R32 and R1234yf.

4. Key Features

- **Adjustable Spark Gap** — Electrode spark gap adjustable from 0.5 mm to 10 mm for precise ignition control.
- **High Voltage System** — Transformer output 0–20 kV with 1 V resolution for stable and repeatable spark generation.
- **Precise Discharge Control** — Discharge time of 0.3 s ± 0.05 s and discharge current of 30 mA with high accuracy.
- **Environmental Simulation** — Dry bulb temperature and dew point temperature can be adjusted to simulate different operating conditions.
- **Explosion-Proof Chamber** — Designed with an explosion-proof simulated environment chamber for safe testing of refrigerant leakage and ignition scenarios.
- **Stable & Repeatable Performance** — Precision high-voltage spark generation system with stable transformer output and accurate timing control.

5. Technical Specifications

Parameter	Specification	Notes
Applicable Standards	IEC 60335-2-40:2022, GB/T 4706.32-2024	A2L refrigerant appliance safety
Electrode Spark Gap	0.5 – 10 mm adjustable	Precise ignition control
Transformer Voltage	0 – 20 kV	Resolution: 1 V
Discharge Time	0.3 s ± 0.05 s	High precision timing
Discharge Current	30 mA	Resolution: 0.01 mA
Dry Bulb Temperature	32°C (adjustable)	Environmental simulation
Dew Point Temperature	27°C (adjustable)	Environmental simulation

Test Chamber	Explosion-proof simulated environment chamber	Safe refrigerant leakage and ignition testing
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6. Typical Test Procedure

1. Prepare the appliance enclosure sample and position it correctly in the explosion-proof chamber.
2. Set the electrode spark gap (0.5–10 mm) and adjust environmental conditions (dry bulb / dew point temperature).
3. Simulate refrigerant leakage inside the enclosure according to the test method.
4. Initiate the high-voltage spark discharge (controlled time and current).
5. Observe and record whether flame propagates outside the enclosure.
6. Document results and ensure safe venting of the chamber before the next test.

7. Applications

- Air Conditioner and Heat Pump Manufacturers — Enclosure flame propagation testing for appliances using A2L refrigerants (R32, R1234yf)
- Testing Laboratories — IEC 60335-2-40 and GB/T 4706.32 compliance testing for A2L refrigerant appliances
- Appliance Safety Certification Bodies — Assessing flame propagation resistance of enclosures for certification
- Research Institutions — Studying flame behavior and enclosure performance of new A2L refrigerant systems

8. Standard Configuration

The standard system typically includes:

- Explosion-proof simulated environment chamber
- Adjustable electrode spark gap system (0.5–10 mm)
- High-voltage transformer (0–20 kV)
- Discharge control for time (0.3 s ± 0.05 s) and current (30 mA)
- Environmental simulation for dry bulb and dew point temperatures

Note: The high-voltage system and timing functions should be periodically calibrated. Regular inspection of the electrode system and chamber sealing is recommended.

9. Ordering Information

To provide the most suitable configuration, please confirm the following when requesting a quotation:

- Primary appliance types to be tested (e.g., room AC, heat pumps, dehumidifiers)
- Required environmental simulation range
- Any need for additional safety features or data logging
- Calibration or documentation requirements

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