

A New Calibration Apparatus of Port Quick Leak Detector for Spacecraft

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Abstract: The leak rate of spacecraft port must meet certain standards during the opening and closing processes. The port quick leak detector can be used to on-line measure leak rates of spacecraft port. In this work, a new calibration apparatus is designed and investigated. It can work at different temperatures with different gases in a wide leak rate range. This apparatus consists of the standard leak rate system, calibration system, temperature control system, gas supply and pumping system, which is designed on the basis of direct comparison calibration method and pressure-rising method with a constant volume, and the leak rates are provided by the standard leak rate system. The calibration range of the calibration apparatus is from 2.9×10^{-6} to 2.9×10^{-2} Pa m³ /s. Its combined standard uncertainty is about 4.7%, and its calibration temperature is from -50 to 20 °C. Within the above leak rate and temperature ranges, the correction factor of the port quick leak detector is about 0.88–1.09.

Keywords: Calibration apparatus; Port quick leak detector; Direct comparison calibration method; Pressure-rising method