VINCI TECHNOLOGIES
Laboratory and field instruments for Petroleum Industry

RTD-RTT - Rotating Drum / Rotating Tube Tester

Evaluate the attrition and abrasion resistance of catalyst particles and catalyst carriers under controlled laboratory conditions.

In Full Compliance with ASTM D4058 & Spence - shell method

The Rotating Drum Tester (RDT) compliant with ASTM D4058 is designed to evaluate the attrition and abrasion resistance of catalyst particles and catalyst carriers under controlled laboratory conditions. ASTM D4058 defines a standardized method for determining the mechanical durability of catalysts by subjecting them to repeated impact and friction inside a rotating cylindrical drum. The objective of the test is to quantify the tendency of catalyst particles to generate fines during handling, transport, loading, or reactor operation, and the result is generally expressed as an Attrition Index corresponding to the percentage of fines generated relative to the initial sample mass.

The device consists of a horizontally mounted drum with an internal diameter of 254 mm and a length of 152 mm. The internal surface has a controlled roughness of Ra 3.2, and a 51 mm baffle is fixed inside the drum. As the drum rotates at the standard speed of 60 ± 5 rpm, the catalyst particles are lifted by the baffle and then fall under gravity, generating repeated impacts and inter-particle collisions. Simultaneously, sliding motion along the drum wall produces abrasion. This combination of impact, shear, and friction simulates the mechanical stresses encountered in industrial processes. The standard test duration is 30 minutes, with a total operational time of approximately 40 minutes including preparation and sieving.
After rotation, the sample is removed and sieved according to the ASTM D4058 procedure. The mass of fines generated is measured and compared to the original sample mass to determine the attrition index. The equipment provides high measurement reliability, with an accuracy ranging from 1 to 7 percent at a 95 percent confidence interval. Repeatability within the same laboratory is approximately ± 0.5 percent, and reproducibility between laboratories is approximately ± 0.7 percent, ensuring strong comparability of results. The compact design of 550 mm by 350 mm by 520 mm and a total weight of 24 kg allows easy integration into research, development, and quality control laboratories.

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Optional Add-On: Rotating Tube (Spence–Shell Method)

An optional add-on module, known as the Rotating Tube based on the Spence–Shell method, complements the RDT by providing an alternative approach to measuring catalyst attrition characteristics. This method is particularly relevant for applications where catalysts are exposed predominantly to frictional interactions rather than high-impact cascading, such as in fluidized bed reactors commonly used in refining plants. The test conditions are designed to simulate industrial handling and operational stress.

The apparatus consists of four stainless steel tubes arranged in pairs on two planes perpendicular to the rotation axis. This configuration enables four simultaneous tests, thereby increasing laboratory throughput and allowing comparative evaluation of different catalyst samples under identical operating conditions. The rotation is driven by a stepper motor regulated by a timer to ensure precise and reproducible operating parameters.
The procedure begins with the preparation of a representative 100 g catalyst sample, which is heated in an oven at 300°C for two hours to remove moisture and volatile components. After heating, the sample is cooled in a desiccator to prevent reabsorption of humidity. From this prepared material, 25 g is weighed with an accuracy of 0.05 g and placed into one of the rotating tubes. The device is then set to rotate at 25 rpm for one hour. During this period, the catalyst particles undergo repeated frictional interactions within the confined tube environment, generating fine particles through surface wear.
At the end of the test, the sample is sieved using a mesh with openings equal to two-thirds of the nominal catalyst particle size. The mass of fines generated is determined, and the attrition resistance and loss on attrition are calculated. In this method, P1 represents the initial mass of catalyst introduced into the tube, P3 corresponds to the mass of fines generated during the test, and P2, defined as P1 minus P3, represents the mass of catalyst retained on the sieve after testing. The attrition resistance (R%) and loss on attrition (A%) are derived from these measured values. The precision of attrition loss measurement ranges from 1 to 7 percent at a 95 percent confidence interval.
Together, the ASTM D4058 Rotating Drum Tester and the Spence–Shell Rotating Tube module provide complementary mechanical characterization tools. While the RDT emphasizes impact and cascading effects, the rotating tube method focuses on friction-dominated degradation. The combination of both approaches allows a more comprehensive evaluation of catalyst durability under different industrial stress conditions.