

Challenges of Measuring a Countersink

Dimension measurement of tapered holes, or countersinks, present unique challenges. Typically, a countersink is a functional surface upon which a fastener head bears force. Because fastener performance is so important in this regard, countersink tolerances are critical. If a countersink is too shallow, the rivet head will protrude, increasing air resistance or not allowing enough fill material to be added. If the countersink is too deep, there may be inadequate skin material for the rivet to hold against the underlying frame. If the countersink is not perpendicular to the surface, once the fastener is inserted, unpredictable stresses to the airframe enter the equation. These conditions could all have an adverse effect on the aircraft's performance when multiplied by the thousands of fastener heads on the skin of an aircraft. Adding to the difficulty is surface material type, complex curvature of the surfaces and the taper angles which can vary in a range from 30 to 130 degrees.

Current tools for measuring countersinks include a plunger-type gauge with a conical shape, designed to fit closely to the surface of the countersink hole. The angle of the plunger on the countersink gauge calls out to a specific angle (30 - 130 degrees). For accurate and repeatable measurements, matching plunger angle that is as close to the part taper angle as possible is essential. When measuring different sized countersink holes, the gauge and/or plunger must be changed out as the angles differ. For an aircraft with thousands of different sized countersinks, this would be a time-consuming process.

The HS743 Countersink Sensor

The HS743 LaserGauge® portable, handheld sensor utilizes 3 laser stripes in a cross-hatch pattern with cutting edge optics and is specifically designed for inspecting and measuring fastener flushness, countersink dimensions and dielectric fill height on flat and complex curved surfaces on a wide variety of metal and composite assemblies. Surface maps are displayed in real-time on the color LCD, and critical measurements are extracted and simultaneously captured to the data table completely defining the quality of the countersink. Measured values include Virtual Fastener Min/Max Height, Countersink Min/Max Radius, Countersink Ave Diameter, Normality and Bearing.

Measurements take less than one second. A rechargeable, lithium-ion battery provides power for constant, portable operation. No cables tethered to a belt or controller. Values can be color-coded to indicate in-spec and out-of-spec conditions for immediate feedback to determine next step in rework process. The standoffs used are unique and provide a centering tip to ensure quick, accurate placement for measuring with repeatability of +/- 0.001". The tips are sized for different ranges of countersinks up to 0.625" in diameter.

Conclusion

LaserGauge® HS743 portable handheld sensor allows the inspection and measurement of a wide range of countersink diameters on curved or flat surfaces on multiple types of surface materials quickly, accurately and with repeatable results.