

Multi-Surface GD&T

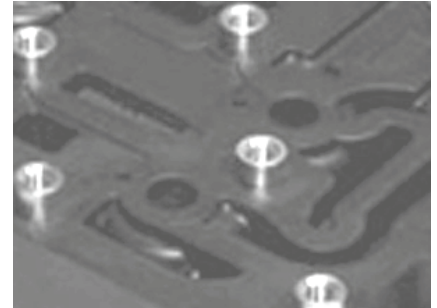
ShaPix® Case Study #903

Multi-surface GD&T relationships of co-planarity, parallelism, spacing, and concentricity determine fits and performance – a CMM requires hours for these results, ShaPix <90 seconds

Rapid multi-surface GD&T verification reduces scrap, rework and warranty costs

Part features on multiple surfaces with GD&T relationships are difficult and often time consuming to measure. The co-planarity, parallelism, distance (separation), concentricity, angularity, and other 6-degree-of-freedom relationships among the multiple surfaces can determine fit and functionality.

Many surfaces may be important on a single part driving the need to confirm their relationships. Rapid verification can save wasted downstream production, rework and warranty costs. Examination of all surfaces is needed to reliably verify the relationships, and doing so quickly achieves the greatest benefit.

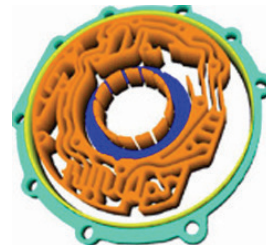


CMM did not provide the information needed

Shown below is a typical pump face with complex geometry, multiple surfaces at various levels and a requirement for co-planarity. Further requirements of concentricity or flatness of a particular surface are possible. Typically a CMM would measure this type of part. The time to program, and fixture can take hours if not days. Once setup the CMM might take many hours to measure to only provide a low density point cloud to extract required parameters.



**Pump housing face
with three surfaces
required to be
parallel**



The ideal measurement tool

To achieve the goal of minimizing costs rapid and accurate metrology is needed. Rapid means quickly setting up diverse multi-surface relationship measurements for different parts, without the need for computer programming. Accurate means measurement uncertainties less than 1 um over high-resolution 3D surface maps covering the parts complete shape.

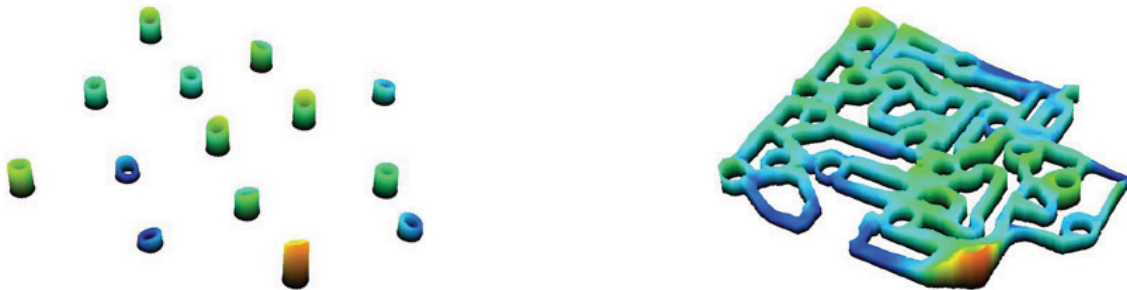
The measurements must rapidly report over-all surface flatness, and the 3D orientation of each surface in a single coordinate system. Further the result must clearly and accurately indicate any locations on each of the part surface where the surface relationships violate specified tolerances. Three-dimensional color-coded visualization is required to make obvious the nature and the amount of any deviations from correct local or global relative surface orientations. Finally reports must be transmitted to any required plant manufacturing data base system.

ShaPix provides rapid multi-surface GD&T verification

The Coherix ShaPix produces a height map with less than 1 um height uncertainty and image resolution of 80 um. Large surface areas are combined accurately via a software 3D “stitching” process if the parts are larger than the ShaPix measurement area. All data sets provide a complete 3D view of the part to manipulate from any perspective. Part surface relationship values and their variations are color coded for easy interpretation. Surfaces not simultaneously visible are related through the use of supplied fiducial devices embedded in the part fixturing.

Examples

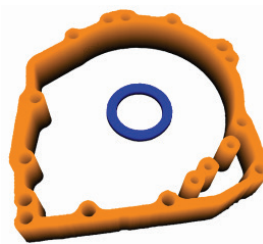
Shown here is the part pictured in close up on the first page. The hollow cylinders are at a different height from the lower plate that is comprised of a worm like structure. The hollow cylinder co-planarity, heights, locations and local tilt are all reported. For the base plate flatness and local “rounding” of the edges of the worm like structure are all reported. This entire measurement was acquired and reported in less than two minutes.



Below a pump with two surfaces whose height spacing, co-planarity and individual flatness are critical. This measurement is not possible with conventional metrology and easy to acquire and analyze with ShaPix.



**Multi-surface depth
and parallelism
measured**



ShaPix increases part performance and lowers cost

ShaPix uniquely combines the accuracy, high image resolution multi-surface GD&T relationships and SPEED for parts from 10 to 300 mm size (and larger for custom systems). This unique combination has provided a complete ROI in one production launch cycle in the time saved bringing a process on line; scrap cost avoided and projected warranty cost.

Coherix designs and delivers high-speed, high-definition, 3D metrology and inspection tools for product development and the management of manufacturing processes for the precision manufacturing and semiconductor industries.

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