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High-Definition Metrology and Vision Application Note #09-07

Diagnosis of Transmission Pump Assembly Issue - a ShaPix Case Study

The Powertrain Challenge



A Coherix Customer, an Original equipment Manufacturer (OEM) needed to rapidly understand the interaction through each stage of the machining and assembly process for a transmission pump cover, shaft/bearing, and flange assembly. Measurements with traditional mechanical probe metrology methods did not reveal any flatness issues or distortion issues.

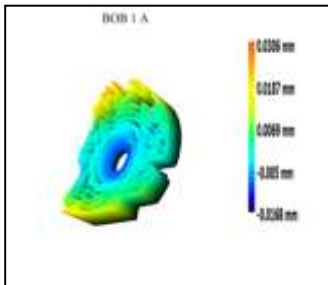
The Metrology Need

The geometric and dimensional integrity of the parts and assembly needed to be measured through 5 sequential steps of the machining and assembly process. Complete coverage of the nominally planar surfaces was required since the root cause, location and failure mode of the assembled part was unknown. There was concern about the assembled part quality because of repeated leakage failures.

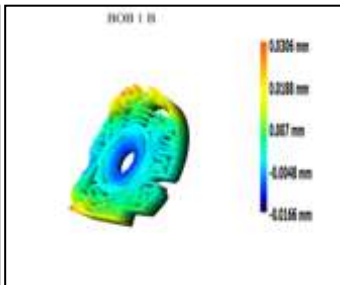
The Measurement Requirements

Since the location and the nature of the root cause of failures was unknown, it was essential that the relevant surfaces be measured completely with high definition. measurement to an accuracy of 1 micron.

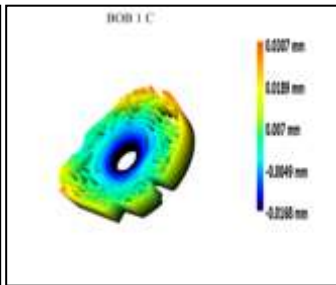
Finished housing



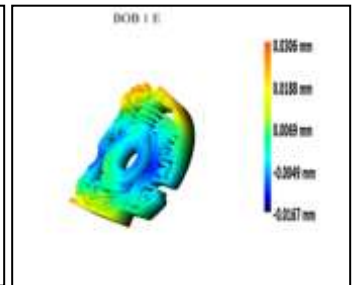
Valves inserted



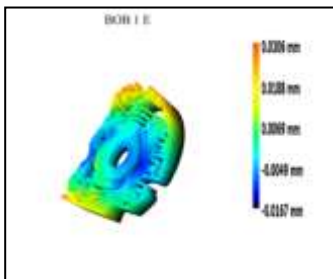
Shaft inserted



Shaft/flange bolted down



Leak tested



The final assembly of the pump cover, shaft/bearing and flange had shown that the end result was assemblies that produced leakage failures. It was not understood where in the machining or assembly process distortion has been created..

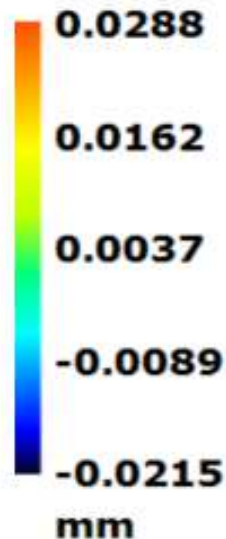
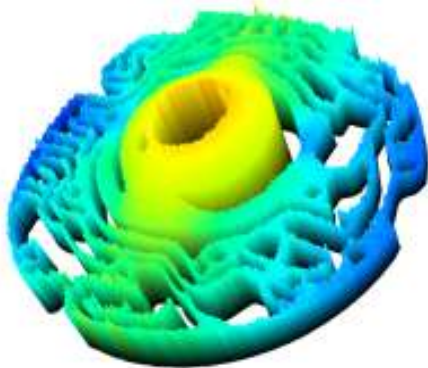
The Coherix Solution

Over a period of a day, the pump cover and assembly components were processed through the assembly steps. **ShaPix** was employed to repeatedly measure the pump cover after each phase of the overall process:

- Pump cover after final machining
- Valves installed in pump cover
- Shaft/ bearing press-fit into the pump cover
- Retaining flange torqued down tightly to the pump housing.

The **ShaPix** measurements clearly revealed a distortion of the pump assembly face occurring during the final phase of the assembly when the retaining flange was bolted down to the pump housing. This distortion was causing leakage and eventual failure. **ShaPix** provided the root cause failure analysis information to guide the corrective action plan – the fastening of the flange to the back of the valve body. A directional and distortion shift of the pump face sealing surface of 0.0503 millimeters was determined to be occurring from the **ShaPix** measurement.

Difference in pump cover shape between final machining complete and flange bolted down



The **ShaPix** high-definition measurement data showed a total peak to peak deviation after final tightening down of the shaft mounting flange of 50.3 microns.

The Powertrain Value Delivered

This **ShaPix** system application

- Reduced and eliminated scrap caused by this assembly issue
- Validated the machining process for the component parts
- Improved part quality
- Rapidly identified the root cause for the failure, and facilitated the problem resolution process.
- Provided quantitative information to guide the corrective action plan.

The basis was established for on-going process control of the machining and assembly of these parts in production, using the proven **ShaPix** high-definition measurement capability.