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Sceptre Application Notes
Tools & Dies Used
Powdered Metal Components and Carbide Pressing Process

In the powdered metal manufacturing process the powdered metal is pressed in a die (block of steel with a precisely shaped hole. The die wall forms the outside or O.D. of the part. The upper, lower surfaces and any internal features are formed by the shape of two rams' that pressed into the die from above and below.

Due to the physics of the powdered metal process, Pressures involved, and subsequent sintering process the Desired shape of the die is different than the desired shape of The final part to compensate for part springs that occurs when The formed part is removed from the die. This difference is not well understood by today's understanding of the technology but is arrived at by trial and error. The cost of this tooling is obviously multiplied by the number of iterations in its development. The only way to reduce the Iterations involved or make a better net part is to know the dimensional integrity of the tools at each step in the Process.

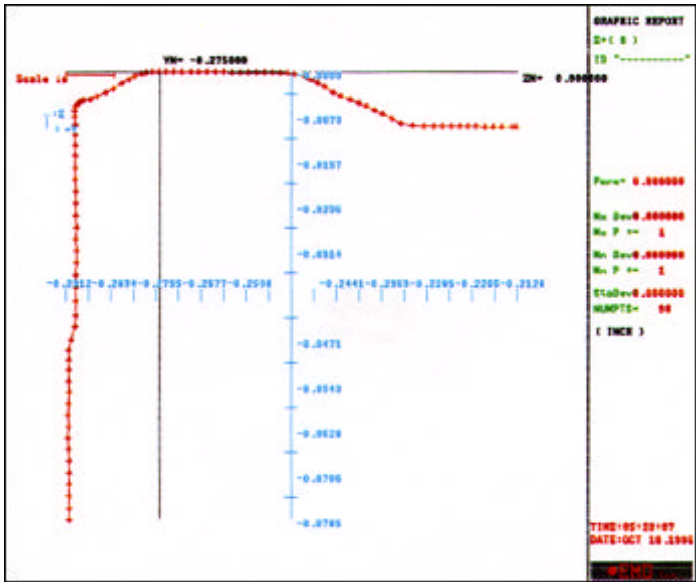
These tools are generally made of extremely hard Materials (i.e. carbide, steel or ceramic) have a variety of Different CNC, hand machining and final polishing operations are done on them before they are ready for production pressing.

Figure 1 - Display of A cross section obtained With constant contact Scanning on the edge of a Ram.

Data was obtained using a 0.3mm Dia Probe stylus

A point density of 0.05mm Was selected

Note: the radical 90 deg. Changes of attitude



The tolerances are generally very tight (typically .0001”). Any clearances between the ram & die obviously will be filled with Material, which will create edges and burrs. Any violations of space between the ram and dies will cause catastrophic results in the press!

Constant contact scanning is the only viable method of inspecting these parts. The amount of detail in the part Shapes require a comparable high amount of inspection data.

These contours change shape rapidly and are truly Three-dimensional measurement tasks. The small geometry’s and nature of these parts lends itself to few alternatives.

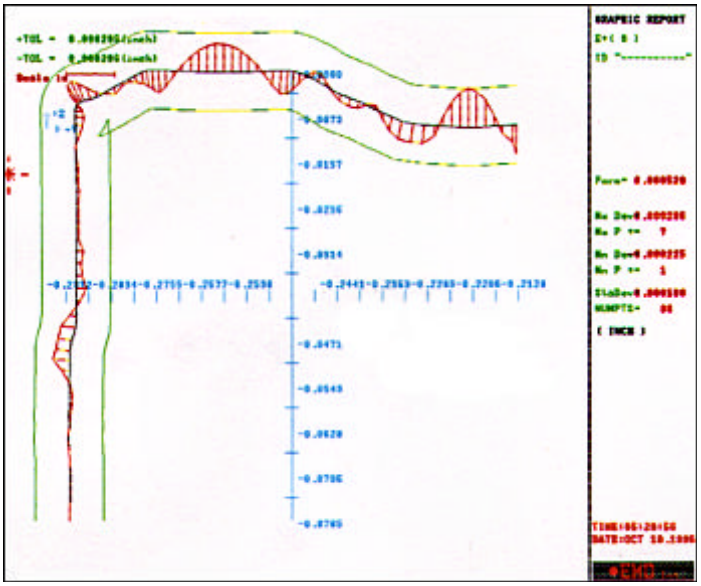


Figure 2 - Display of Data in Fig.1 compared To the nominal profile Desired from the CAD Drawing. This is a Actual-Nominal comparison.

In this mode we are Determining the quality Of the ram based on a Tested design which has Been defined in a CAD Drawing.

The variation between the Two is magnified in RED.

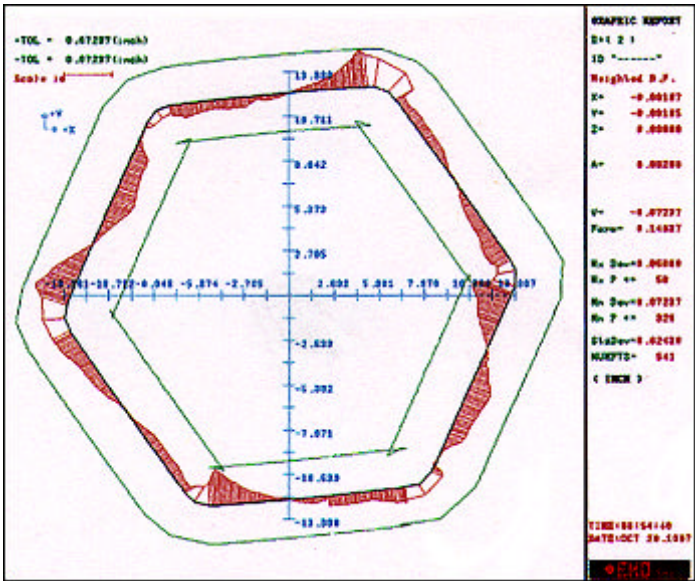


Figure 3 - Display of a External OD cross Section of the ram 5mm Below the edge or top of the RAM.

Data was obtained using a 0.5mm dia. probe stylus

A point density of 0.1mm Was selected

A scan speed 0.5mm / sec

Data was evaluated against The nominal

Figure 4 - Display of A surface feature on the Ram which molds a Contoured hole into the Powdered metal.

In this case the Center or black line is The data from one ram Compared to data from the Opposite ram. (Male & Female Features on the two rams)

The RED indicates the Clearance between the two.

In this mode we are Determining the FIT Between the male and Female features on the Ram independent of the Design of the rams.

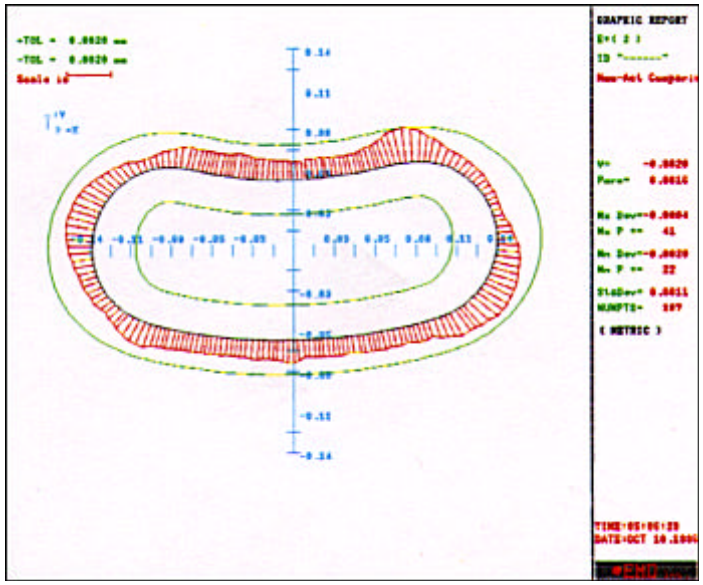
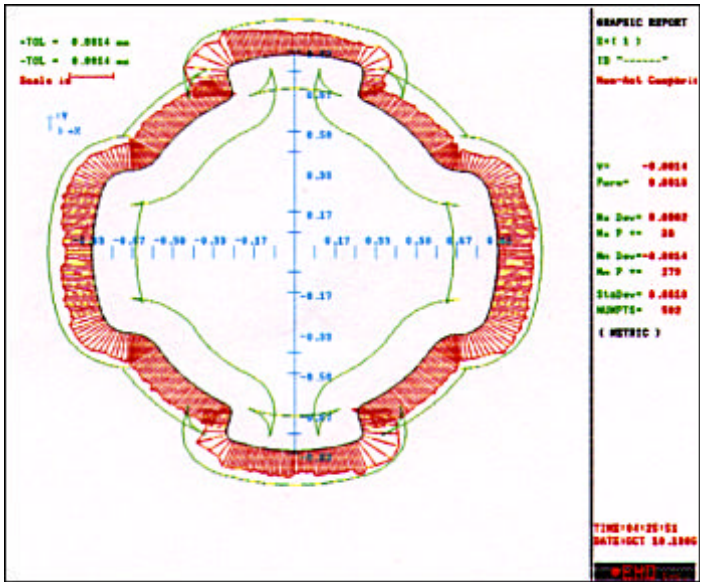


Figure 5 - Display of Die (Internal) cross Section evaluated Against a ram (External) Cross-section.

In this case the Center or black line is The data from the ram.

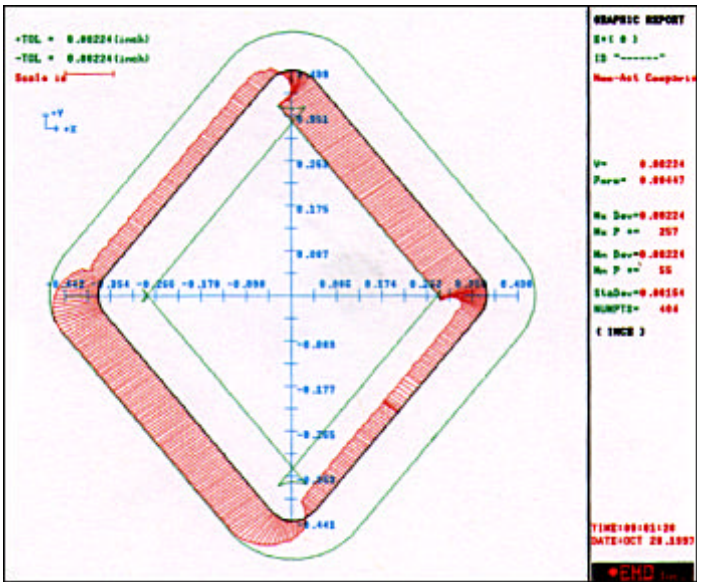
The RED indicates the Die.

In this mode we are Determining the FIT Between the ram and Die independent of the Design of these Components.



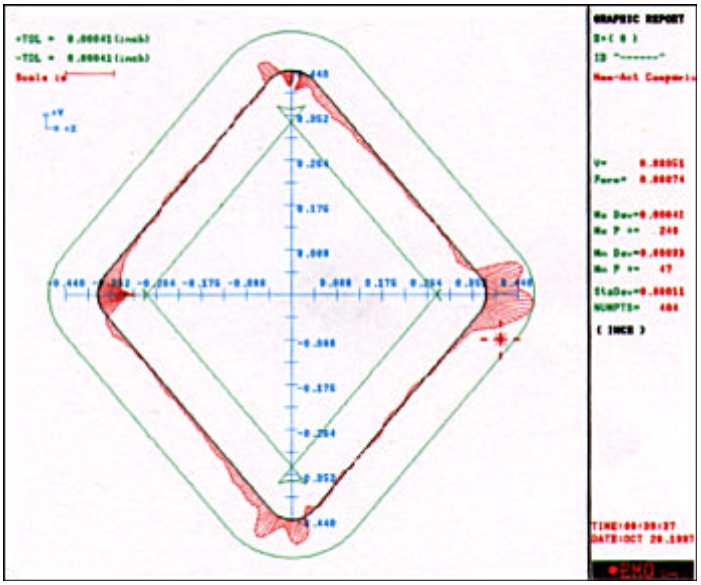
In the carbide insert industry the symmetry of A geometry to itself is of key importance. This might lead to indexability specifications of the final product.

Figure 6 in this Case we might take A data set and index It around 180 degrees. We then do an Actual-nominal Comparison of this Data to the original Data.



To the extent that The common reference System (i.e. outside Diameters do not match) We can see an offset.

Figure 7 Data from Fig 6 which has been Best fit for X&Y shift And theta - rotation. This is the optimum Offsets between the Ram and dies in the Presses so they have The best clearances.



The resultant form Variation is indication Of part symmetry.