## Mercedes test cut comparison between legacy CNC88 –5 CPU and Calmotion 527F control. March 23, 2016

A 1997 Fadal 6030 VMC with a –5 CPU and AC motors was used to perform the Mercedes test cut. The Mercedes program is designed to identify a machine's capability to perform several types of cuts. Reversal, ramp control, mechanical integrity, and ability to follow a contour tool path are among the attributes that can be identified by analyzing the finished part. The test performed below consisted of changing only the control cards of the legacy Fadal CNC 88 HS and the Calmotion 527F. The same program was run on both controls without modification. Identical backlash and survey data was used by both controls. The existing AC servo amplifiers and motors were left undisturbed.

The replacement of the Fadal –5 CPU and axis cards with Calmotion 527F controller boards was completed in less than 15 minutes.



Fadal -5 CPU Mercedes test cut 3200 mm/min

Results: There are minor defects in the parts, however, the surface finish and overall quality of the part is reasonably good.

Fadal -5 CPU Mercedes test cut 6400 mm/min



Results: At a higher feed rate, the Fadal –5 CPU begins to falter as evidenced by the distortion of the part integrity.

- 1. Scallop marks appear at several locations on the part
- 2. Due to poor ramp control, the tool reverses on the edges of the part and does not complete the cut.
- 3. One of the features that had a slightly oval shape at 3200 mm/ min now has more of a football shape to it and the fillet edges are misshaped
- 4. Tool marks that were once horizontal, now have a angle to them with less consistent spacing to them
- 5. A feature that was once rectangular is distorted and has developed a pointed tip to it
- 6. Although not visible from a top view, these areas were flat but now have a slight angle to them
- 7. The diagonal cut surface and the adjoining straight direction cut do not properly mesh
- 8. The Z axis does not maintain position at all times during the program and leaves witness marks
- 9. The ends of the slot are no longer round. The fillet edges of the slot are misshaped
- 10. The features that were previously rectangular have lost their shape. In addition to being distorted, the surface to surface intersections are violated.

Calmotion 527F Mercedes test cut 6400 mm/min



Results: At a higher feed rate, the Calmotion 527F CNC retains its shape and does not distort the part integrity as the –5 CPU does.

- 1. Scallop marks are not evidenced on the part surface
- 2. With improved ramp control, the tool properly reverses on the edges of the part and completes the cut.
- 3. The features with the slightly oval shape at 3200 mm/ min has not been affected by the higher feed rate
- 4. Tool marks that continue to be horizontal with consistent spacing between them
- 5. A rectangular feature in the part retains its shape and does not develop a point
- 6. Although not visible from a top view, the surface top is flat and has not been distorted
- 7. The surfaces mesh properly
- 8. Uncontrolled Z axis witness marks do not appear at higher feed rates
- 9. The end of the slot maintains a round shape and the fillet edges remain consistent
- 10. The rectangular shape is maintained and there are no surface to surface violations



Fadal CPU –5 6400 mm / min Surface integrity compromised



Calmotion 527F 6400 mm / min Surface integrity maintained



Fadal CPU –5 6400 mm / min Irregular spacing and diagonal tool path



Calmotion 527F 6400 mm / min

Regular spacing with proper tool path

Side by side comparisons of feature integrity



**Fadal CPU –5 6400 mm / min** The oval feature has developed a football shape



**Calmotion 527F 6400 mm / min** The feature has maintained its shape at a higher feed rate





# Fadal CPU –5 6400 mm / min

A feature that was rectangular has developed a pointed tip to it and has scallop marks



**Calmotion 527F 6400 mm / min** Shape integrity is maintained with good surface finish



#### Fadal CPU –5 6400 mm / min The tool does not complete its path resulting in the two surfaces not meshing well.



## Calmotion 527F 6400 mm / min

Better ramp control results in proper meshing of surfaces maintained with good surface



**Fadal CPU –5 6400 mm / min** Diagonal tool path inside the feature as well as Z axis witness marks on the surface



Calmotion 527F 6400 mm / min Horizontal tool path is maintained with good surface finish



Fadal CPU –5 6400 mm / min Rectangular shape has been lost at higher feed rate



Calmotion 527F 6400 mm / min Rectangular shape is maintained