Location Independent PPAP Streamlined Global Manufacturing

University of Michigan Automotive Conference
August 2000
By Rod Groleau

In the world of JIT and flexible manufacturing systems, it is critical to be able to move tooling quickly and effectively to production facilities around the world. To make this happen, the process must be documented in a simple yet comprehensive manner that allows:

- Identical parts to be produced on dissimilar machines in different plants;
- Easy communication of processing concerns between technical resources located around the world;
- Minimized paperwork to reduce transfer costs.

This case study presents the feasibility of such an approach using actual injection molding tooling. This approach allows the process engineer to direct the setup of a process using data from key parameters inside the cavities of the tool, which is where the *real* process takes place. A system called eDART™ allows this sharing of data to happen via phone modem or the Internet from virtually anywhere on the globe.

THE STRATEGY

When developing an approach to allow this technique to be feasible, it is important to understand the underlying concept of the PPAP or Production Part Approval Process.

The Production Part Approval Process, developed by the automotive companies, mandates that whenever a process is changed it must be revalidated to determine that parts meet the specification and that the normal process variation is acceptable. This process mandates that whenever tooling location is changed, the process must be re-qualified depending on their interpretation.

Processors often find it necessary to stretch the PPAP guidelines when machines break down, scheduling conflicts occur, or production levels can not be met on a timely basis. Many times tooling would be moved to another location (such as another plant, supplier, or country) if it weren't for the PPAP constraints.

NEW STRATEGY

The strategy employed in this case study is to utilize key parametric data from inside the tool cavities and replicate the process on a machine and location-independent basis utilizing this data. The part used for this study is a component supplied to Honda by DJ/Nypro of Louisville, KY. It was chosen because of the small size of the tool and the production demand, allowing it to be taken out of production for utilization in the study. DJ/Nypro is a joint venture between DJ, Inc. and Nypro of Clinton, Massachusetts.

The original data was taken during a qualification run at the Louisville, Kentucky plant, while the study was monitored by modem in this case by RJG, Inc. in Traverse City, Michigan. Parts were collected and saved. During the run, abnormal process variation was noted on this machine, however, parts were considered in spec when checked. The DJ/Nypro process engineer wondered if this was an acceptable run or

should the source of this variation be corrected before proceeding? Because this was a case study, it was decided that the results of the first run would stand and the mold was shipped to another DJ/Nypro facility in El Paso, Texas along with the electronic template of the key parametric data from inside the mold.

Once at DJ/Nypro in El Paso, the mold was placed in another machine of a different clamp tonnage, shot capacity and manufacturing make. This was intentional in order prove the concept. Material of the same type from a different lot was used *also* to show proof of concept. The results of both qualification runs were then compiled for analysis at RJG.

At this point, the mold was shipped to Traverse City for a third run in preparation for the International Automotive Conference in Traverse City, Michigan in August of 2000. With the mold at RJG, the electronic template supplied by DJ/Nypro (Figure 1) was utilized to set up the process in a 45-ton Cincinnati Roboshot electric machine. This was an electric machine with a different screw and barrel size making it totally different from the other machines.

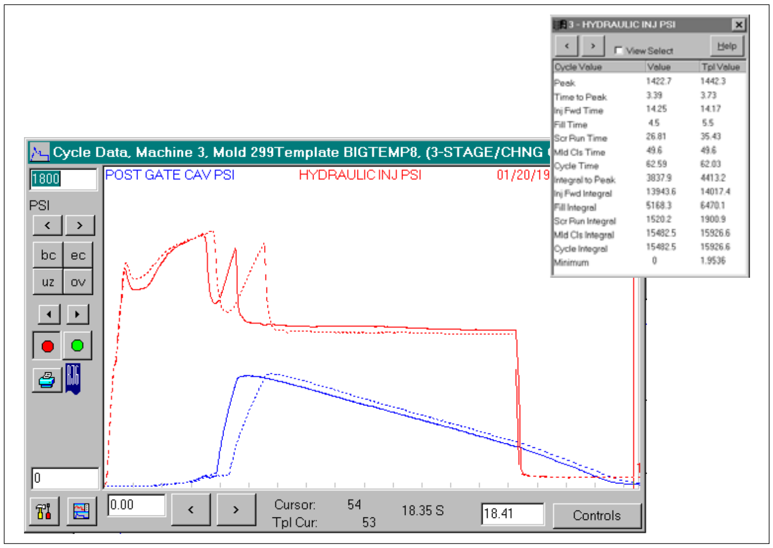

Figure 1

With the template matched, the mold was put through PPAP again at RJG. The parts from all three independent PPAPs were sent to DJ/Nypro in El Paso for inspection and measured so that critical dimensions could be validated at one source. This eliminated the measurement error from different systems. The data was plotted using the same scale as shown in Figure 2. The result was virtually the same process capability from all locations. This shows the fallacy of requiring approvals when tools are moved provided that parametric data from inside the mold, where the parts are made, is utilized to match the process and determine its capability.

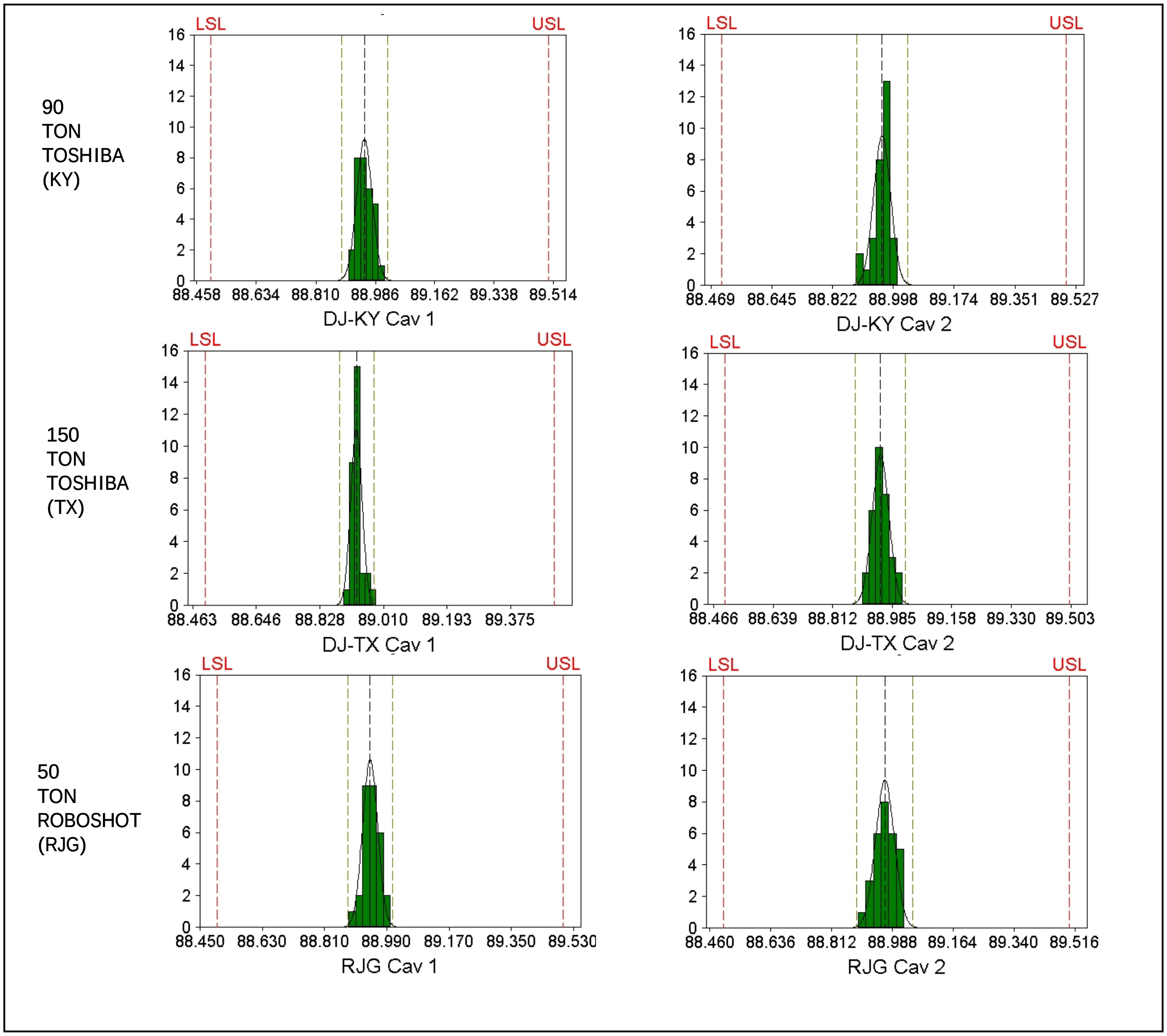

Figure 2

As part of the supporting documentation of this study, data from the RJG QST molding facility was also analyzed to show the concept of machine independence. In this case, a job was run, monitored and controlled over a two-year period in the plant using parametric data from inside the cavity. This job was run on several machines over the period. The range and standard deviation data from a critical dimension is shown for that two-year period in Figure 3. From this data one cannot determine where the machines were changed. Figure 4 shows the data again with the machine changes overlaid onto the data. By comparing the two figures, there is virtually no difference when templates are matched and data is run as defined by the original capability study.

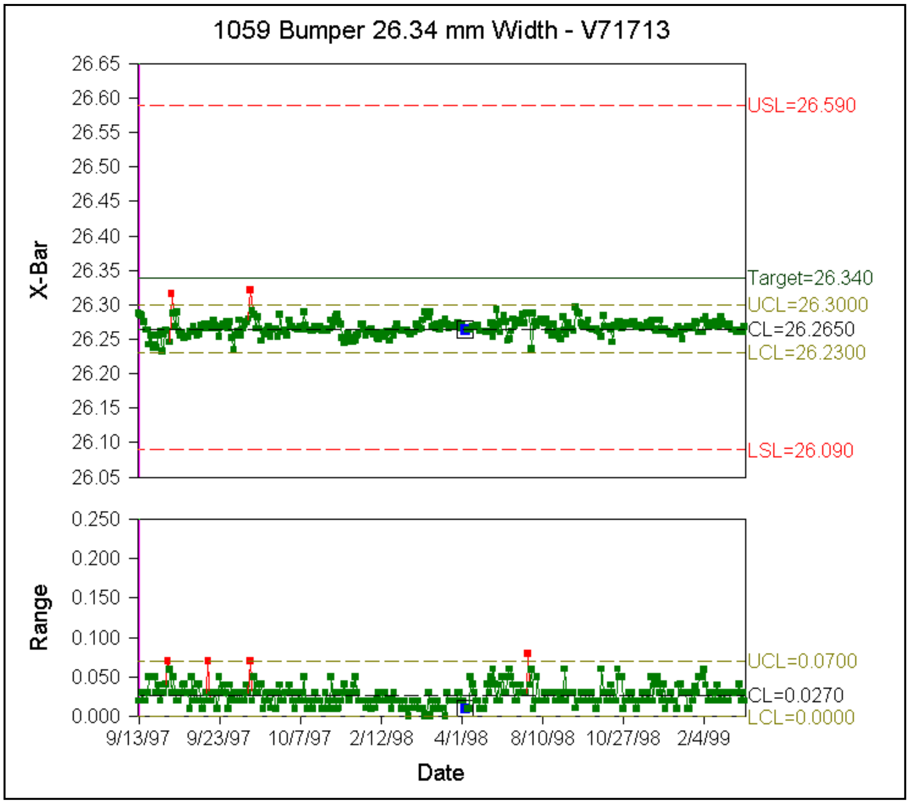

Figure 3

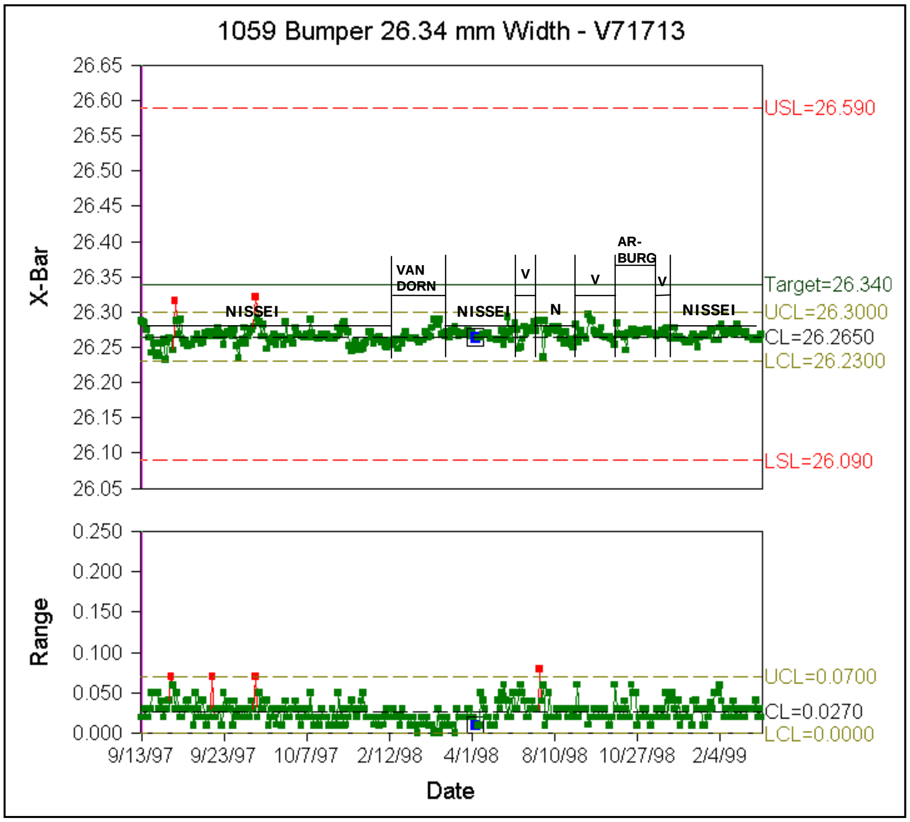

Figure 4

These case studies demonstrate matching mold pressure templates virtually melts away the machine differences and the process truly becomes machine-independent. This is the essence of the new order for production approval techniques, which will liberate industry from the need to revalidate processes whenever processes are relocated.