Tool & Die Troubleshooter

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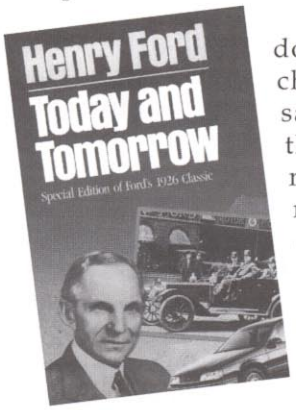
Press and Die Maintenance: New Technologies

"Continuous Improvement is Essential to Our Success." This is one of the most important statements on the Ford list of Mission, Values, and Guiding Principles.

In his book "Henry Ford Today and Tomorrow", published in 1926, Henry Ford wrote about continuous improvement.



He said, "We do not make changes for the sake of making them, but we never fail to make change once it is demonstrated that the new way is better than the old way. We hold our duty to permit nothing to stand in the way of progress." Henry Ford also spoke of the principles of quality, employee involvement, and research by trial and error. Over the years his principles have today made Ford a leader in new technology, experimentation and process implementation.

In our two previous articles on Press and Die Maintenance we addressed problems encountered in press and die damage due to overloading, hard hits and overloads 3" above BDC (Bottom Dead Center) using inverted draw dies in toggle presses. To overcome these problems, Ford launched a F.T.P.M (Ford Total Productive Maintenance) Process utilizing new technologies such as Signature Analysis & Process Monitoring.

This article will explore new technologies in use now, and planned for the future, at Ford. These new technologies will help protect presses from overload, prevent serious die damage and also improve stamping part quality.

Part quality in any stamping operation, is a direct result of "quality control." Using the technology currently in place and by knowing the current press capacity limits, Ford is able to maintain new control and quality limits within the press. Full **Critical Curve Monitoring** (a part of "Signature Analysis") extracts and records readings all the way through the stroke of a press in real time. Ford has the upper and lower press capacity limits for part quality in place. However, the proper quality control limits must be established and must be as tight as possible. These limits are job specific and can only be established after die set. Testing is under way to find out what are the statistical limits at Chicago Stamping. At Chicago they are experimenting on the newly refurbished line #15 and on one of the oldest lines #23. At issue is, what are the differences between running a new technology on older versus newer lines?

Signature based process control or "Signature Analysis" (originally called "Foot Prints") is the computer based system which effectively monitors an isolated process variable. In the metal stamping operation, the force needed to form the raw material can be isolated as a dependent process variable, directly related to part quality. This information is derived from the traditional load monitors. Digital high speed processors for critical curve monitoring are used to generate tonnage wave forms or signatures for identifying potential press and die problems (see fig. 1, pg. 4). The computer graphic software displays, stores and retrieves tonnage information in

Jim Hathaway, monitoring a signature analysis system at Chicago Stamping.

wave forms. The data is recorded on a SPC (Statistical Process Control) computer system. The SPC system takes the average of five strokes and will automatically plot the data to a mean of the upper and lower control limits. Each peak load of a press is determined with each press cycle. If the tonnage is incorrect the SPC will automatically and continuously determine the problem, activate the user interface, light up the quality alert buttons and instantly shut the press down.

A patented process by Ford called "Feature Extraction" takes the signature idea a step further by measuring statistical variance from job to job by recalculating the variables such as metal thickness or material (bake hardenable or aluminum etc.). Ford also patented the development of the mathematical calculations necessary to correlate the blank thickness and material properties from run to run.

see ***Maintenance*** *on page 4*

Maintenance *continued from front page*

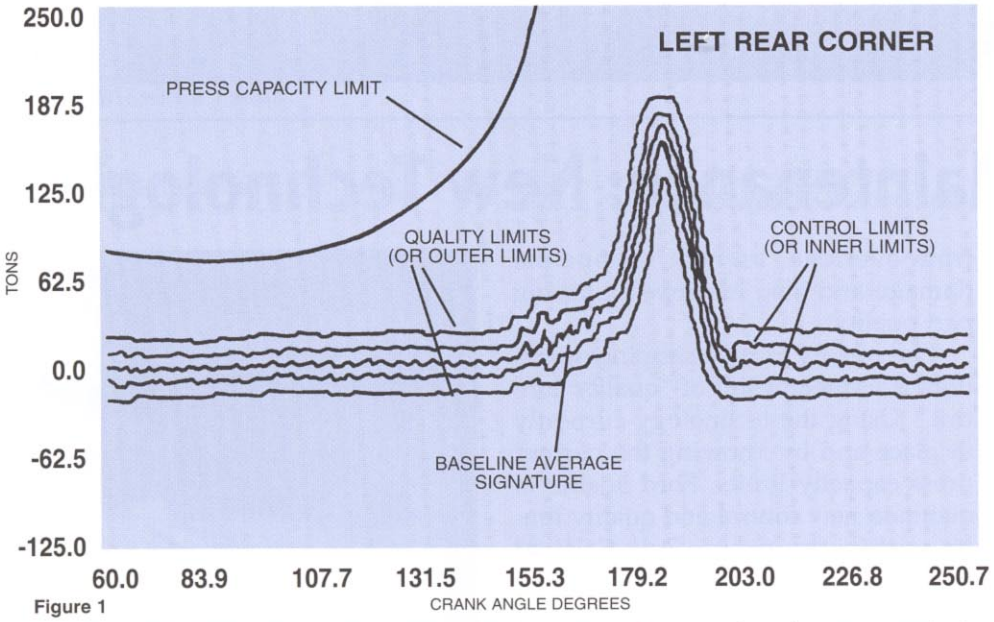


Figure 1

Signature Wave Form Technology can be simply compared to a motion picture vs. a single snap shot. A "Signature" press protection system in the stamping process is like recording a movie of on-going trends and multiple operations in real time. The old methods of press protection could protect against press overload but not much else.

The competition has nothing to compare.

Press protection pilot programs currently at Ford include utilizing press sensors on the older presses. On presses with inverted draws, the overload sensors are located on the under drive pullrods or frames. In the future it may be possible to place sensors directly on the tooling to obtain information as to what is happening to the tooling. With most electrical sensors, problems occur with wires which can easily break (especially when the dies are washed). Remote sensors without the wiring may be the answer, but further testing will be required. Another unique device, currently a requirement at Ford, is called a "Resolver". A resolver sensor mounted on the crank will read out the position of the ram on the press. The load monitors which extract information from other sensors and resolvers may be used for detecting metal thickness variables and work hardening properties.

Also in the future, load monitors will control events such as part eject, part transfer, short feed and any overloads which may occur during the forming operation of the press cycle. Improved controls for the prevention of hard hits and die damage will be in the process preventing damage to the tooling. Increased use of die sensors will make the dies smart with "Die Recognition Interface." The DRI is a stainless steel disc about the size of a small coin which will recognize a tooling problem in the press and will automatically select a correct setting for that tool or activate a press alert or shutdown. The sensor mounted directly on the die is automatically read by the DRI computer software system. Other new features that have potential for usage at Ford include thermographic and infrared technology to detect defects or split panels.

Progressive dies typically require more tonnage during the forming operation than during the piercing and trimming operations. The new monitors allow the press operators to set tighter working tonnage limits around the important forming operation and to display the reverse or snap- through tonnage during the press stroke. Newer monitors such as "Hour Meters" allow maintenance personnel to record the frequency of press maintenance based on production time of the press and "Tool Job Counters." This will allow the tool and die department to keep more precise records of the number of hits on a die between maintenance periods.

The other piece of the puzzle for the future is in the implementation of the Tonnage Management Process. This process management recommendation is a direct result of the work of the **Ford Press & Die Damage Elimination Task Force**. The process will only work if it's put into place and the people are allowed to become accustomed to, and trained on, the new technology. As familiarity with Process Monitoring increases, it will be ordered on the new equipment. Presently being ordered at Ford is equipment for Critical Curve Monitoring. After the launch of the Tonnage Management Process we are sure to see increased demand for Process Monitoring. Wayne Stamping regards the process monitoring as so important that they have six systems installed on their tandem lines (lines 3&4) and training is now in process.

With the new technologies and cooperation by the employees at Ford, we now see that the goal of defect free and cleaner parts, produced without frequent interruption for maintenance or repair, can be attained.

Henry Ford also said, "Our invariable reply to it can't be done is, Go do it." The Henry Ford tradition continues in earnest at Ford Motor Vehicle Operations.

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