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Steelmaker Improves Testing Accuracy

As a leading U.S. producer of open-die forgings and manufacturer of steels used to make plastic injection molds, hot work forging dies, and die casting dies, stringent attention to quality is both a company tradition and the highest priority for A. Finkl & Sons Co., Chicago.

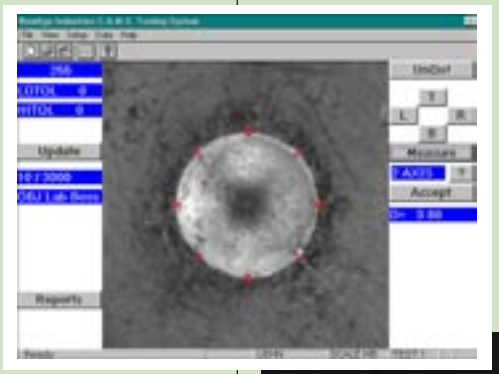
Every forging sold by the company is ultrasonically and Brinell hardness tested prior to shipment. And Finkl has invested in new systems to improve the accuracy and repeatability of its Brinell hardness inspection systems.

COMMITMENT TO BRINELL

There are a number of different hardness measurement tests that can be utilized to test forgings. The various tests arrive at a test hardness value by different measuring techniques, ranging from gauging the relative rebound height of a bouncing test penetrator to measuring the penetration depth that an indenter achieves under a standard static load.

Finkl uses the Brinell hardness test method for testing all of its forgings. Finkl officials believe the Brinell test is the most dependable hardness test method because the 3,000 kg. test load produces a significant amount of surface deformation. Accurate measurement of this deformation yields a correlation of the forgings' resistance to deformation, or surface hardness. The magnitude of the deformation produces a uniform hardness measurement.

Perhaps the only weakness of the Brinell system, according to Marvin Phillips, quality control manager, is its dependence on operator measurement of the resulting indention using a 20X optical magnifier (a Brinell "scope"). "In traditional Brinell testing, the inspector reads the Brinell indentation diameter to the nearest 0.05 min on a graduated scale marked with 0.1 mm divisions," Phillips explains. "Two inspectors can easily differ by 0.05 mm when reading the same spot." A 0.05 mm difference in reading can result in a hardness result that varies by as much as 5 to 20 Brinell points. "Obviously," Phillips notes, "we wanted to find a more dependable and repeatable technique for measuring the diameter of Brinell indentations."



The Binell Impression is displayed on the Lab B.O.S.S. monitor so the operator can position the test head properly for measurement.

Test personnel at A. Finkl & Sons can observe the test measurement process on the computer monitor.

COMPUTER-DRIVEN OPTICAL SCANNING SYSTEM

After extensive research to find a system with better accuracy, Finkl selected the B.O.S.S.â (Brinell Optical Scanning System) from Newage Testing Instruments, Inc. for in-plant trials.

This instrument uses a compact, hand-held video camera system that illuminates the Brinell impression, captures a video image, and makes a measurement using proprietary Newage software to calculate the diameter of the impression at many angles, based on the high-contrast edges.

The B.O.S.S. comes in two models. The Lap B.O.S.S. is a portable model that uses a Laptop computer cabled to the scan head to make the measurement and store the readings. The Lab B.O.S.S. is a desktop computer-based system that is available in a variety of optional enclosures and tethers. The monitor displays the indentation with indicators superimposed showing the defined edges of the impression. In either model the entire inspection sequence takes place in only two seconds. This data is then stored in a file with any other descriptive data the operator inputs where it can be statistically manipulated, sorted by adjustable tolerances, converted to other scales, or printed in almost any way desired.

Finkl tested the Lab B.O.S.S. system by comparing manual operator scope readings with the B.O.S.S. readings. The operators were not informed that the qualification was in process to ensure that data would be collected under typical conditions. The testing regimen called for checking the forging hardness first with the Lab B.O.S.S. conventional reading by an inspector using the optical Brinell scope, and finally correlating and analyzing all of the data.

A number of results were quickly apparent. it was dear that some operators were better than others at maintaining a tighter range in standard scope measurements and some operators had a slight skew in their data. In addition, the Lab B.O.S.S. exhibited a tighter range of scatter in its data as compared to that measured by any of the operators.

Calibration with the B.O.S.S. is quickly and easily checked against the test block manufacturer's calibration Impressions.

100% B.O.S.S. VERIFICATION

According to Guy Brada, Finkl's chief metallurgist, the results of the test sufficiently impressed company officials. "As a result of the favorable test findings, we have equipped all of our Brinell testing stations with Lab B.O.S.S. measurement systems. These systems represent a significant investment for the company, however the benefits of accurate, repeatable hardness measurement and automatic computerized data collection justify these costs This improvement in our hardness testing technique has helped to improve the quality of our products," Brada says.