QUALITY TOOLS
Solving Problems for Manufacturers

Hardness Standards to Change

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Special Affiliates and web sites

- Keeping up with Hardness Testing http://www.instron.com/hardness/index.asp
- Non-Destructive Inspection Methods http://www.foerstergroup.com
- Dimensional gaging http://www.thegagestore.com
- Shore http://www.shoreinstruments.com
- NIST http://physics.nist.gov/cuu/Uncertainty/index.html

Next Issue Topics

Micro hardness Image Analysis reducing costs for case studies

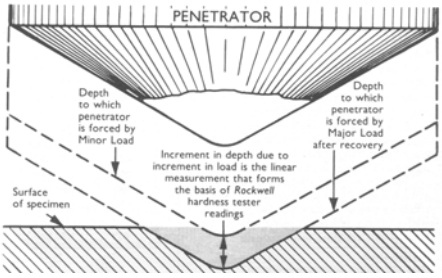
Digital Durometers finally get with the Program!

Trouble shooting your Rockwell

Inside this issue:

NIST Announces Changes

NIST /ASTM announces an impending change to another specification for Rockwell Hardness testing requirements that will impact your quality procedures and most likely require some minimal investment in hardware and training. For the last several years, ASTM and NIST have been reviewing Hardness testing standards with the intention of making improvements in the standards such as ASTM E 18, E 384 and E 10. Reviews of the C scale standardization were carried out several years ago and now a sweeping change in the methods and requirements that will effect ball penetrators/B scale testing is about to be officially sanctioned by NIST.



Typical Penetrator Representation

In an interview with Mr. Ed Tobalski, VP of Engineering for Wilson Hardness division of Instron, we have been informed that sometime in the next few months NIST will officially change the 1/16" steel ball now in use for over 40 years on B scales, to require a carbide ball for NIST compliance. This change will mean that you, as a manufacturer, will have to consider changing the ball you now use, if it is steel, to carbide and also the calibration and verification test blocks will have to be replaced. From the information we have gathered from the Wilson/Instron calibration labs they have been offering test blocks calibrated with steel as their prime and carbide as an option but that will change as soon as NIST announces this change, Wilson will still offer calibration of these test blocks with a steel ball as an option or for those of you who require it, or in certain cases "dual" carbide and steel calibration, but the default will conform to the NIST standard. The impact of this change on your Rockwell tester is not at all certain, though theoretically with the carbide ball and carbide calibrated test blocks you should see no impact. We can assume

Your Rockwell's R&R is Costing Profit ?

Generally speaking, what's the difference between a standard dead weight or spring load machine and, lets say, the latest Load cell closed loop machine like the Wilson model 2000? Basic tests have shown the difference is very measurable with a model 2000 providing a G R&R of less than 5% on a +/- 3 point tolerance on C scale. Alternately, the average mechanical machine is hard pressed to do better than 25% to 50% on the same +/- 3 point tolerance. What does this mean? Using these dead weight and spring load cell machines could mean a variation in the reading you see of between 1.5 to as high as 3.0 points. The variation in your machine can be up to ½ of your tolerance. In short are you measuring the product variations or are you measuring the variations in the hardness tester. Additionally, we have to understand the accumulative error if the testing machine is not absolutely accurate "error of measurement". If your

NIST Changes Continued….

that some of the older Rockwells that may be already struggling to remain certified due to age and wear, may not be certifiable any longer which may impact your capital spending plans. Of just as much importance, is whether everyone will change over and adhere to the new NIST pronouncements or will certain companies or even departments within companies struggle using both a steel and carbide ball for the testing. This is an area of great concern and will be an area for potential liability if you do not have a plan to address the issue. Tests have found significant differences in readings on the softer material, exacerbating the normal debate between machines and companies on the absolute readings they find.

R&R Continued…..

machine has a typical gage R&R error along with an accuracy shift, which is normal for these types of machines (example: RCH 62.9 +/- with a test block error of .5pts can read C 63.4). It is not uncommon to have a machine still meeting the basic intent of ASTM E 18 and reading within the allowable test block range while costing you money with less than perfect readings. Pictured here are two examples, first a normal process distribution fig A, with all measured values within the allowable tolerance. Fig. B shows the actual cumulative effect on the same product sample using a tester that met the ASTM requirements for certification but whose GR&R was at 40%. You will notice that the actual distribution of readings is slightly skewed off the desired mean value or nominal. In this case the accuracy error was only slight but it is not unusual to find much worse error of measurement.

The result in this case are parts that are either scrapped due to them falling out of the acceptable tolerance range. Or worse yet, parts that end up in finished products that may not meet the design criteria for their application causing premature product failures or warranty replacement costs. The bottom line is that these machines are costing manufactures hard earned profits. No longer should a manufacturer be satisfied that the tried and true old standard is good enough and think that it is cheaper to keep using these old style machines to guide their process and product decisions. Scrap is not cheap, a lost contract can spell the end of a business these days and none of us want to think of the awards handed down daily by the courts in product liability settlements. One final thought. If you are struggling with rising energy costs just think what it can mean to your bottom line to run your furnaces to reach the minimum level of change in hardness required rather than what you do now!

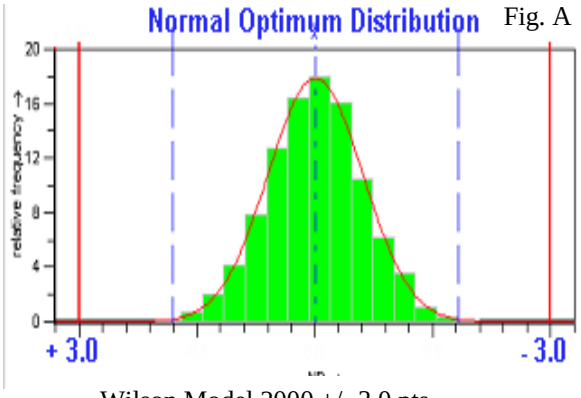


Fig. A

Wilson Model 2000 +/- 3.0 pts.

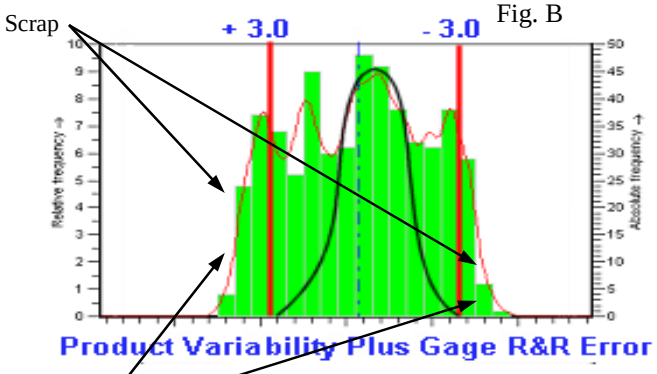


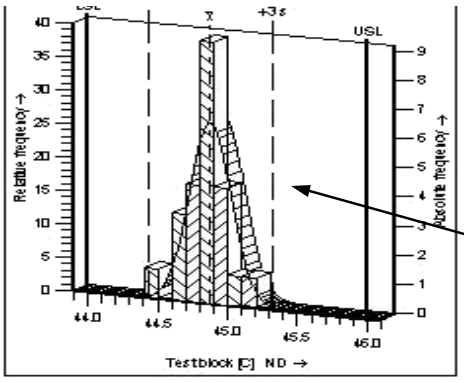
Fig. B

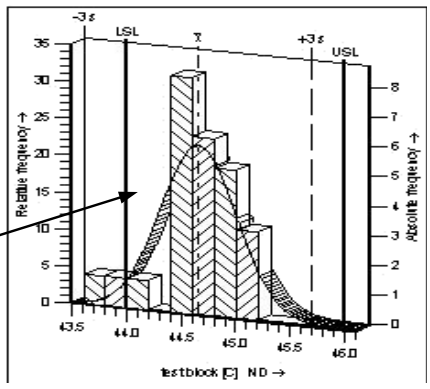
Dead Weight/Spring Load +/- 3.0 pts

Non Recoverable Energy Cost

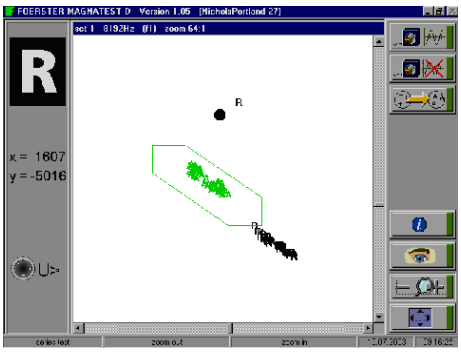
It's your money & Your decision.

This or This





When Indentation Testing May Not Be Acceptable



Eddy-Current Sorting Hard from soft Parts

Not all hardness requirements can be satisfied with indentation methods. There are Non-destructive methods being used by major manufacturers successfully to sort acceptable from unacceptable parts as they relate to hardness and case depth using eddy current technology. Though this method is not for every application, it is another valuable tool that lets the manufacturer quickly verify hardened and quenched condition without making an indentation in the material. We have to speak of the limitation of this test because there are numerous issues that have to be considered such as part geometry and mass, chemistry, part orientation and hardness specification range required. After all it really is not a Rockwell Test is it!

The test is basically a comparative test, unlike a true Rockwell indentation test and as such is affected by a variety of variables that may or may not be related to the actual part hardness as arbitrated by an indentation test. These tests are very valuable for sorting hardened from unhardened parts reliably. They are even used to evaluate the relative depth of case on parts or the location of the hardened zones on parts quite reliably. The key in all successful applications is knowledge of the variables that can change the eddy current readings and controlling these variables to just one or two. The figure shown is a series of acceptable parts represented inside the accept box with the unacceptable parts shown outside the acceptance box. Remember, the eddy current probe or coil is really seeing the related permeability differences between the parts and that difference is displayed in a variety of presentations. Normal procedure is to take a sample batch of randomly chosen acceptable parts and determine the average and range values. Then taking unacceptable parts a comparison is made. The equipment shown is compliments of Foerster Instruments in Pittsburgh, Pa. They have been providing both equipment as well as complete testing solutions for over 50 years and are available to run a short evaluation study to determine if your application can be successfully inspected with this technology. In addition to determining the “Pass-Fail” condition of the part in these NDT systems tests have been made on certain parts to determine the “General” acceptable level of case depth within a part without destructive sectioning. Again this method is used as a process control method in the manufacturing area and is an acceptable augmentation to the standard cutting and polishing required to certify absolute case depth. When high levels of production and difficult processing require a continuous surveillance, eddy current can be another tool in your arsenal.

You Tested IT but Did You Document IT?

ISO, TE QS, NADCAP, Q1 and so on and so on have driven home the message of quality and process documentation with a vengeance. If you are like almost every other manufacturer, you have less people, more work and even more paper work required to document your overworked process. Not only are you required to process and ship the parts but you have to put systems in place that document your inspection process and validate the test results you observed. It is inarguable that these requirements to “Document What You Do” have increased non-productive overhead while supposedly delivering the “Quality and Systems” improvement for your manufacturing. Hardness testing, for the last 50 years has been a skill and almost an art form using the old mechanical hardness testers to measure the samples and make the adjustments required. Today you are being asked to meet tighter requirements or simply GO OUT OF BUSINESS! You are also being asked to validate your process, verify your measurement instrument and in general provide statistical proof that you are running a process that is in control and performing at least to a 1.68 cpk. With today’s sophisticated testers you are in a position to actually reduce the direct labor cost required to document your process and procedures. Recently we were fortunate enough to install a new Wilson 2001T with several modules of software designed specifically to allow real time data review and collection directly over the customers LAN system. Because the 2001 has the ability to send the data via a RS 232 port and the software modules we provided are comprehensive statistical packages, the only obstacle to overcome was the installation and transmission of the data from the heat treat area to the quality offices. This was done successfully using the standard LAN office computer network cables already in the plant. The Heat Treat department had a simple software module installed that allowed them to see the running process of the furnace, save the readings taken and file them on the companies main frame for future reference. The Quality department received two additional modules, one which allowed the manager to actually observe the readings being taken in heat treat real time and a second to analyze the data in a more sophisticated manner to allow for corrective actions and improvements.

This was done **without** any added intervention of the inspector on the floor other than taking his normal hardness test. The data

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Process Documentation Continued...

was sent automatically to both his local computer and to the main frame. If a full remote station is not what meets your requirements keep in mind Wilson/ Instron and ITS can provide simple solutions that file the data automatically in your Excel workbook right at the hardness tester. Data collection does not have to be difficult or costly.

ISO17025 Measurement Uncertainty Alert

NOTE: If you are certified to ISO17025 you need to make sure you're capable of meeting the requirements for measurement Uncertainty. Wilson/Instron service engineers are positioned to perform uncertainty evaluations on your hardness testers to help you meet this requirement. This is a critical requirement and we are here to help. You will need to let them know of your specific needs