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THE SHOT PEENER

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In This Issue

THE CARE AND FEEDING OF YOUR ALMEN GAGE

By Jack Champaigne

"***Shot Blast Testing***" U.S. Patent No. 2,350,440 ushered in a new age of control to the shot peening process. John Almen had devised a method to quantify the "intensity" of the peening process and thereby brought a degree of scientific accuracy to the art of peening. (See THE SHOT PEENER, Volume 3, Issue 1).

The gage was later refined and renamed Gage Number 2. The replacement of the knife edges with round balls was intended to recognize the occurrence of both spanwise and chordwise curvature of the Almen strip. Specifications in use today describe Gage Number 2 in general terms but omit details of calibration, certification and retirement. The accuracy, precision and repeatability are not defined. The only mensuration quantity mentioned is resolution (0.001"). Although this may imply characteristic of accuracy to some tool and die makers, it isn't clear (to the author) what calibration and certification requirements are applicable. This doesn't necessarily prevent a gage from being calibrated. It just fails to declare calibration specifications.

A new service performed by THE SHOT PEENER includes sales and certification of Almen Gages. When the gage is calibrated, it is then declared to be certified if it meets the requirements of one or more specifications.

The most popular industrial specification (in the U.S.A.) is the Society of Automotive Engineers (SAE) Specification J442. Its military equivalent is MIL-S-13165 Rev. C. The illustrations used for both specifications is reproduced in Fig. 5.

In addition to these requirements, THE SHOT PEENER has established additional requirements. These include specifications for allowable deterioration to the four (4) support balls and the tip of the indicator stem. Figures 1 through 4 depict the measurement error attributable to these characteristics.

Certification of the Almen gage by THE SHOT PEENER involves:

a) Inspection
b) Refurbishment
c) Calibration
d) Issue Certification

The inspection process focuses on two areas, the indicator and its mounting holder (anvil). The indicator is inspected for clarity of dial, freedom of stem travel and signs of backlash. The anvil is inspected for integrity, alignment and condition of the four support balls.

Any worn parts (ball wear exceeding 10%) are replaced and an alignment check is performed. The anvil (ball placement) is then calibrated (measured) and certified to be within applicable specifications.

The indicator is calibrated and if no flaws are detected (backlash, stickiness, accuracy) it is certified. The performance of actual versus indicated distension is graphed and a copy accompanies the certification.

At the completion of the certification a sticker is placed on the gage assigning a serial number and recommended date of recalibration. A written certificate of calibration accompanies the gage.

The equipment used by THE SHOT PEENER for Almen gage certification is periodically calibrated and certified traceable to NBS.

The basic calibration charge is $100. Refurbishment is quoted in advance and is generally less than $200. Upgrading from standard mechanical pointer movement indicator to electronic digital indicator costs $500. If a zero block was returned with the gage, it will be calibrated (check for flatness) and certified. If none was returned, a new one may be purchased.

Figure 4 summarizes the affect of worn gage parts on accuracy. Once ball wear exceeds 10% the accuracy (for .024" deflection) exceeds .001". This is the limit adopted by THE SHOT PEENER for declaration of End of Life and the balls must be replaced.

For a free (IBM compatible, floppy disk) copy of the AutoCadd drawing files used for this article, circle Bingo No.1. *Continued on page 2...*

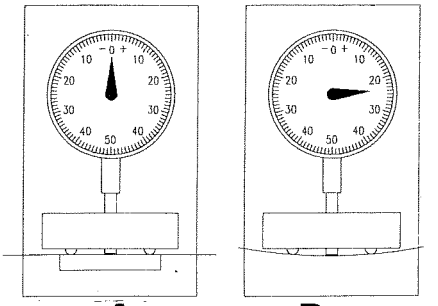
MEASUREMENT ERRORS DUE TO WORN GAGE PARTS

Figure 1 illustrates a new gage assumed to be in ideal condition. Figure 1A shows establishment of zero reference (datum line). Figure 1B shows resulting extension of indicator tip due to measurement of an Almen strip with 0.024" deflection.

Figure 2 illustrates the influence of a flattened indicator tip. Figure 2A shows that the gage is re-zeroed to establish the datum line and Figure 2B shows the indicated deflection of the same 0.024 Almen strip. The error in indication occurs due to contact at the periphery of the tip rather than point contact of the tip.

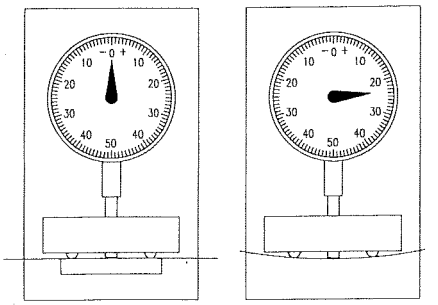
Figure 3 illustrates the influence of flatness of the four (4) anvil balls shown to be worn to 80% of its original diameter. Figure 3A shows that the gage is re-zeroed to establish the datum line and Figure 3B shows the indicated extension for an Almen strip of 0.024" deflection. The error occurs due to contact with the outside edge of the anvil ball, not the tangency point that would have been available without wear.

Figure 4 illustrates the percentage of wear caused by worn gage parts.



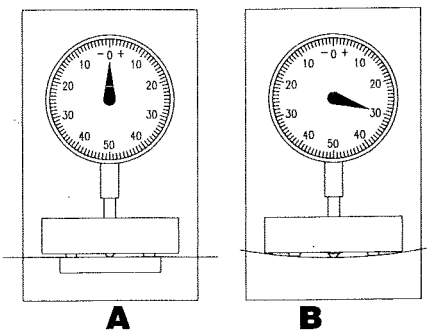
INDICATED	ACTUAL
.0240	.0240

FIG. 1 IDEAL CONDITONS



INDICATED	ACTUAL
.0237	.0240

FIG. 2 TIP AT 80% WEAR



INDICATED	ACTUAL
.0300	.0240

FIG. 3 BALLS AT 80% WEAR

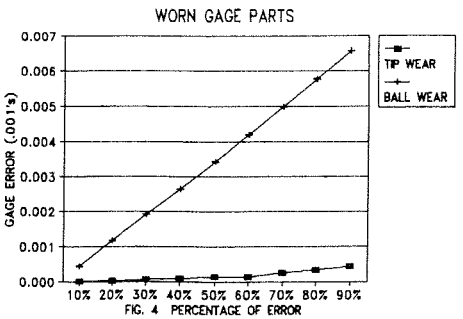


FIG. 4 PERCENTAGE OF WEAR

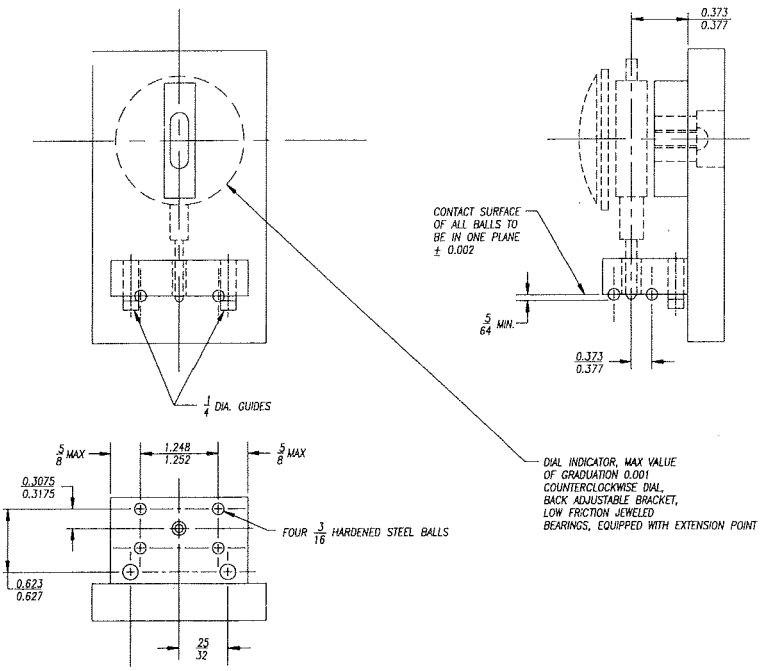


FIG. 5
ALMEN GAGE ILLUSTRATION USED FOR BOTH SAE-J442 AND MIL-S-13165 REV. C