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Guidance for the Calibration of Microscopes

This document provides guidance from the Primary Standards Laboratory to customers for the calibration of microscopes.

Microscopes are used in a variety of applications. Most of these applications involve inspection, under some appropriate magnification, of features, potential debris, flaws, cracks, etc. that are called out through a drawing or other requirements document. In cases where the requirement states that a given magnification value or range be used, the production agency has the responsibility to assure that the microscope used is set to the proper magnification factor or is within the required magnification range. Many microscopes have an adjustable 'knob' for magnification for ease of use. Therefore, calibrating such a microscope by writing a certificate, certifying a given magnification factor and installing a label would in many cases require sealing or locking the adjustable knob. This may not be a cost effective process in many cases.

An acceptable means of confirming the magnification factor is to calibrate the microscope at time of use using a calibrated glass scale and an eyepiece reticle (also known as a stage micrometer). In this process the operator places the calibrated glass scale on the microscope stage and, using an eyepiece mounted reticle, adjusts the microscope magnification to match the glass scale dimensional marks. This process should be documented through a work instruction or other appropriate means. A good practice would be to confirm the magnification factor at the start and finish of the inspection process. The level of required documentation should be commensurate with the consequences of a mistake leading to an improper inspection result. This would include the decision on whether to record the file number or identification of the calibrated glass scale. Some situations might require full documentation of the traceability path of the standard (glass scale). For example, if important direct dimensional data are documented then the trace path should be documented.

In cases where no eyepiece reticle is present and it is desired to confirm the microscope magnification factor the following process may be used:

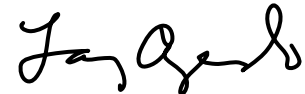
The only equipment needed is a millimeter scale ruler.

- (1) Confirm that the eyepiece field diameter is as marked on the eyepiece. (A typical eyepiece might be marked 10x/22, which indicates a 10x magnification on the eyepiece, and a 22 mm field). To confirm eyepiece diameter, remove an eyepiece, and inspect the diaphragm size inside the eyepiece. This number is "D".
- (2) Replace the eyepiece into the microscope.
- (3) Place the ruler on the microscope working area. Move the ruler until the markings are across a diameter (approximately). Record the measured field of view. This number is "F"
- (4) D/F should be approximately equal to the zoom setting marked on the objective. Beware! Some microscopes will include the eyepiece magnification on the zoom (i.e. marked 5x-50x, rather than 0.5x-5x).
- (5) If D/F is correct per step 4, then, the total magnification is equal to the eyepiece magnification factor multiplied by D/F.

The above method works well on inspection microscopes for qualitative results or stereo microscopes with low magnifications (typically 6x to 50x total magnification). It should not be used where dimensional data is required to be reported.

This information is posted on the PSL websites <http://www-irn.sandia.gov/calibration/msp-home.htm> (internal to Sandia) and <http://www.sandia.gov/psl/> (external to Sandia).

On Behalf of the PSL,



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