# PJLA Update Notification

**Update Notification # 7**
**Update Notification Release Date**: February 25, 2010
**Form/Procedure/Policy**: Guidance Paper on Surface Plate Calibration

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PJLA Accredited Calibration Laboratories
CC: PJLA Assessors and Staff

Surface plate calibration is a fairly common activity in dimensional calibration labs. By the nature of their size and mass, these calibrations are typically done in the field at customer sites. The most common reference standard for surface plate calibration is:

***Federal Specification GGG-P-463c Plate, Surface, Granite 12 September 1973*** and
***Federal Specification GGG-P-463c Amendment 1 15 June 1977***

PJLA has identified the need to provide a guidance document regarding surface plate calibration to establish consistency among calibration labs and to ensure a clear understanding on the part of calibration service clients as to exactly what surface plate features are being calibrated.

The above mentioned standard identifies 6 different acceptance tests for surface plates as follows:
Group A Tests:
>    Thickness & Stiffness
>    Surface Texture
>    Squareness
>    Seams

Group B Tests:
>    Repeat Reading Measurement
>    Flatness of Working Surface

Group A Tests are typically performed during manufacture and are not test which require continued confirmation through calibration. Although from a technical standpoint, thickness is affected by resurfacing of plates to restore their flatness to acceptable limits, the small amounts of material removed during resurfacing operations has no appreciable affect on the stiffness of the plate. When plates are manufactured the thickness is greater than that required to provide adequate stiffness. This is done to accommodate natural variations in composition of plate material, resulting variations in the mechanical properties of the plate material and manufacturing variations resulting from the grinding operation required to produce and maintain flatness and surface finish of the plate.

For purposes of this document we will concern ourselves with the Group B Tests since labs typically are calibrating a surface plate that has been "accepted" and are only confirming through calibration that the plate remains within the working tolerance for its grade or that it meets customer defined dimensional requirements.

The entry on the scope of accreditation for MEASURED INSTRUMENT, QUANTITY OR GAUGE must list the specific calibration activity, **Flatness** or **Repeat Measurement**.

The range of sizes which can be calibrated must be listed in the RANGE field. For Flatness this is typically given as a range of minimum to maximum diagonal size. Beginning a range with (0.0) or "up to" is not acceptable since plates are not available in zero diagonal size and the equipment used for calibration has a lower limit of operability. Selection of a reasonable number as a minimum diagonal size should reflect limits of the equipment available for the calibration and the smallest commercially available plate sizes. The diagonal size may only be listed in ft (feet) or in (inches) for USC units or in mm (millimeters) or m (meters) for SI units. For Repeat Measurement this is typically given as a maximum vertical variation from a reference plane which the method and equipment employed by the laboratory can detect. The vertical variation may only be listed in in (inches) for USC units or in mm (millimeters) for SI units.

**BMC** (Best Measurement Capability) must be determined and indicated for each calibration activity. An uncertainty calculator program is available by request from PJLA to assist with this determination and is consistent with the "Moody" method of calibration. PJLA assumes no responsibility for the accuracy of this program and offers it only as an aide to individual laboratories.

The equipment used for each specific calibration activity must be listed in the **Remarks** field. As an example for Flatness calibration a **Planekator** or **Autocollimator** might be used. For Repeat Measurement a **Repeat-O-Meter** would be the typical calibration instrument.

Shown below is a representative Scope of Accreditation entry for Surface Plate calibration.

Dimensional

| MEASURED INSTRUMENT, QUANTITY OR GAUGE | RANGE (AND SPECIFICATION WHERE APPROPRIATE) | BEST MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±) | REMARKS |
|---|---|---|---|
| Surface Plate | | | |
| Flatness | 10 in  to 72 in diagonal | $(21 + 0.72D)$ µm | Autocollimator |
| Repeat Measurement | 0.002 in | 60 µin | Repeat-O-Meter |

While a customer might request only a Flatness calibration or only a Repeat Measurement calibration, a thorough and complete surface plate calibration requires both. In exercising its accreditation responsibilities (under 4.4.1 c and 5.4.2 of the ISO/IEC 17025-2005 standard) the laboratory should inform the customer of the advisability of a full calibration including both Flatness and Repeat Measurement and the inadequacies of a partial calibration, either Flatness only or Repeat Measurement only,  ensuring that the customer understands the differences. Any resulting contract should indicate the nature of the calibration to be performed. In either case the calibration certificates issued to customers must clearly indicate the nature of the calibration (Flatness and Repeat Measurement, Flatness only or Repeat Measurement only).

Listed below are the appropriate elements of the ISO/IEC 17025-2005 standard referenced above.

**4.4.1** *The laboratory shall establish and maintain procedures for the review of requests, tenders and contracts. The policies and procedures for these reviews leading to a contract for testing and/or calibration shall ensure that:*
*a.) the requirements, including the methods to be used, are adequately defined, documented and understood (see 5.4.2);*

*b.) the laboratory has the capability and resources to meet the requirements;*

*c.)* ***the appropriate test and/or calibration method is selected and is capable of meeting the customers' requirements*** *(see 5.4.2).*

**5.4.2** *Selection of methods*

*The laboratory shall use test and/or calibration methods, including methods for sampling, which meet the needs of the customer and which are appropriate for the tests and/or calibrations it undertakes. Methods published in international, regional or national standards shall preferably be used. The laboratory shall ensure that it uses the latest valid edition of a standard unless it is not appropriate or possible to do so. When necessary, the standard shall be supplemented with additional details to ensure consistent application.*

*When the customer does not specify the method to be used, the laboratory shall select appropriate methods that have been published in international, regional or national standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment. Laboratory-developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated. The customer shall be informed as to the method chosen. The laboratory shall confirm that it can properly operate standard methods before introducing the tests or calibrations. If the standard method changes, the confirmation shall be repeated.*

***The laboratory shall inform the customer when the method proposed by the customer is considered to be inappropriate or out of date***.

We hope that the above information has provided you with invaluable insight. Assessment staff will be utilizing this document as guidance for all future assessments.  Our policy (PL-4) for displaying such calibrations will be updated soon. We would expect that all accredited laboratories participate with PJLA with making the necessary updates to your certificates. If you have any questions in regards to this guidance, please feel free to contact Henry Alexander, Calibration Program Manager at halexander@pjlabs.com .

Thank you.