**Title:   Calibration Method for Surface Plates**

**1.0      Scope :**
This calibration method is applicable for:
a)   Surface Plate

**Range:** Any range For Flatness Determination

**2.0      Ref. Master / Equipments Used For Calibration:**
a. Electronic Level (Nigata saiki) (RCL/EL/03)
b. Leveling screw jack.
c. Temperature Indicator (RCL/TDL/02)
d. Measuring Tape.

**3.0      Principle used in calibration   :**  Comparison of UUC with reference standard of known value for Flatness

**4.0      Reference  Indian/ International Standard  :   IS 12937- 1990**
**Cast iron IS: 2285-2003           Granite IS: 7327-2003**

**5.0   Steps before Calibration Work:**
a.   Before leaving for site calibration, calibration engineer will ensure functioning of the ref. Standards and equipment to be used for calibration and verify its accuracy with the help of ref. master or retained standard kept by the laboratory. Lab will keep the verification record with every check sheet for respective calibration item and then collect all the items as check list **RCL/L1/FR/08A**.
b.   Clean the Surface Plate thoroughly.
c.   Examine the Surface Plate visually and verify that surface is free from dents and damage.
d.   Ensure its proper Identification no. If ID no. is missing on Surface Plate, Then Lab. ID will be identification for every record including calibration certificate.
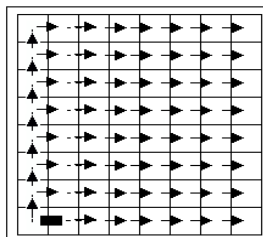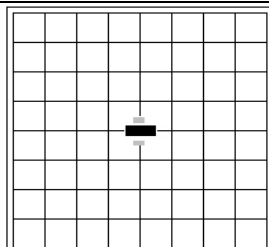
**6.0   Calibration Procedure:**

**For confirming the Flatness of Surface Plate**
a.   Confirm the size of the surface plate and mark the grid spacing of 125 mm as shown in the Fig. If plate is having odd size and gridding is not done equally, then leave the border from all sides of plate.
b.   Set the  zero position at center to X.Y Axis  on Electronic Level
c.   Mark the all corner as A,B,C,D,
d.   Consider the  first  block reading as Zero For Datum Plane
e.   Then take the readings in each block and note down  (As shown in fig 8D)
f.    while taking the reading direction should be as per Fig

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*Grid marking and Leveling of surface plate to ground level*
*Measurement of flatness*

g. Then calculate the flatness as per the Procedure given below.
- Make the table as per the Fig 8E for all values
- Then add the cumulatively all values as shown in Fig 8F
- Then creating a one datum plan make the zero at other two corners.
- Divide the corner value by nos. of blocks minus one.
- Obtained value should be given opposite sign of corner readings and all values to be added algebraically to the table.
- Repeat the procedure for other corner also.
- Once all three corner value comes to zero the max. and min. value will be the total flatness of the plate.

**6.1** When ref. Standard and equipment is brought back in the laboratory, Once again calibration engineer will ensure functioning of the ref. Standards and equipment which are used for calibration and verify its accuracy with the help of ref. master or retained standard kept by the laboratory. Lab will maintain the verification record in respective Checklist **RCL/L1/FR/08A.**

**6.2** The card will be signed by respective inspector.

**6.3** The card is to be forwarded for preparation of the certificate.

**6.4** After completion of calibration, a sticker is put on the Surface Plate to indicate the calibration and next due date of calibration.

**7.0 Calibration job card Format no. : RCL L1 JC 04 SP**

**8.0 Components of Measurement Uncertainty:**
Following minimum important components are considered for estimation of measurement uncertainty.
- Repeatability - minimum five repeated measurements.
- Uncertainty in the calibration of Reference Standard/Equipment used.
- Uncertainty due to Accuracy of Reference Standard/Equipment used.
- Uncertainty due to Resolution of Instrument/Equipment.

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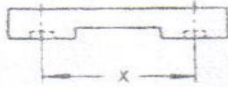
FIG. 8A
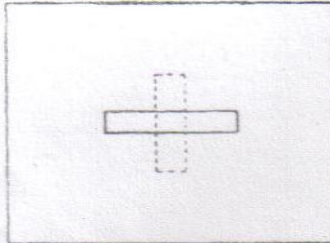
FIG.8B

| $E_1$ | $E_2$ | $E_3$ | $E_4$ | $E_5$ |
|---|---|---|---|---|
| $D_1$ | $D_2$ | $D_3$ | $D_4$ | $D_5$ |
| $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ |
| $B_1$ | $B_2$ | $B_3$ | $B_4$ | $B_5$ |
| $A_1$ | $A_2$ | $A_3$ | $A_4$ | $A_5$ |

FIG.8C
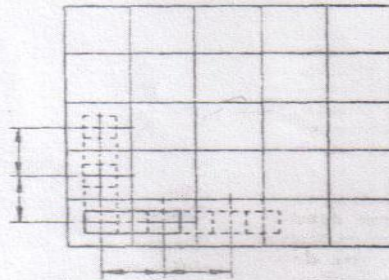
FIG.8D

| $e_1$ | $e_2$ | $e_3$ | $e_4$ | $e_5$ |
|---|---|---|---|---|
| $d_1$ | $d_2$ | $d_3$ | $d_4$ | $d_5$ |
| $c_1$ | $c_2$ | $c_3$ | $c_4$ | $c_5$ |
| $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ |
| $0$ | $a_2$ | $a_3$ | $a_4$ | $a_5$ |

FIG.8E

| $b_1+c_1+d_1+e_1$ | $b_1+c_1+d_1+e_1 +e_2$ | $b_1+c_1+d_1+e_1 +e_2+e_3$ | $b_1+c_1+d_1+e_1 +e_2+e_3+e_4$ | $b_1+c_1+d_1+e_1 +e_2+e_3+e_4+e_5$ |
|---|---|---|---|---|
| $b_1+c_1+d_1$ | $b_1+c_1+d_1+d_2$ | $b_1+c_1+d_1+d_2 +d_3$ | $b_1+c_1+d_1+d_2 d_3+d_4$ | $b_1+c_1+d_1+d_2 +d_3+d_4+d_5$ |
| $b_1+c_1$ | $b_1+c_1+c_2$ | $b_1+c_1+c_2+c_3$ | $b_1+c_1+c_2+c_3 +c_4$ | $b_1+c_1+c_2+c_3 +c_4+c_5$ |
| $b_1$ | $b_1+b_2$ | $b_1+b_2+b_3$ | $b_1+b_2+b_3+b_4$ | $b_1+b_2+b_3+b_4 +b_5$ |
| $0$ | $a_2$ | $a_2+a_3$ | $a_2+a_3+a_4$ | $a_2+a_3+a_4+a_5$ |

FIG.8F

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