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Sieving Machine Calibration Using a Profile Projector with Standard Method ASTM E-11 2004

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ABSTRACT

Sieving machine is used to sift material of sand and stone previously mixed. Sieve machine is a measuring instrument to determine the size of sand grains that can be used in building construction. The purpose of this research is to calibrate the sieving machine using profile projector with standard method ASTM E-11 2004. Based on this research, the conclusion of calibration data of sieving machine has been obtained. It was found that the sieving machine used in this research can be used to determine the size of sand grains used for construction. The uncertain value of the width opening sieve is 15.8 µm and the diameter of wire is 0.02 mm, so that the value of evaluation is lower than the allowed geometry deviation limit. Thus it can be concluded that the sieve machine is still within the permissible geometry tolerance limit.

KEY WORDS: *sieving machine, calibration, profile projector*

1.0 INTRODUCTION

Sand is an important material in the field of building construction, whether in the form of residential houses, places of worship, offices, and buildings of educational facilities and other buildings. Uniform sizing material is often required in building construction. Sand material generally consists of sand that is still mixed with gravel and stone. Sand like this should be sifted first before used for building construction materials. (Feblil Huda et al, 2010)

Sifting is a way of grouping granules, which will be separated into one or more groups. Sifting can also separate the particles from passing through the sieve (fine grain) and remaining in the sieve (coarse grain). The specific grain size that can still cross the sieve is expressed as a boundary grain [1].

Sand sieves are used to sift the sand material or in the form of previously mixed stones. So mesh / sieve becomes a measuring instrument that determines the size of sand grains that can be used on wake / construction. The purpose of sifting is to prepare feed products that are appropriate in size for the next few processes. Sifting prevents imperfect mineral entry in crushing (primary crushing) or oversize into subsequent processing, so that it can be re-done the secondary crushing process. Enrichment to improve the specification of a material as the final product. Sifting also aims to prevent the entry of undersize to the surface. The sieving is usually carried out in a dry state for coarse material. The measuring instrument before or after use in a certain period (6 months or 12 months), calibration must be performed according to national or international standards. Measuring tool is the spearhead in the quality of the resulting product, because it is directly related to the process, so it needs to be calibrated correctly and maintained to get a long life time [2].

Calibration aims to determine the deviation of the conventional truth of the value of the appointment of a measuring instrument, or the dimensional deviation of a nominal property of a measuring material. The deviation value will show the quality of the measuring instrument, the smaller the deviation value the better the quality of the measuring instrument. Each measurement must contain an error [2].

Profile projector (optical comparator / shadowgraph) is an optical measurement device that enlarges the workpiece surface and is projected on a linear / circular scale. Projector Profile also known as an optical comparator is a measuring instrument that can measure small objects. The projector magnifies the profile of the specimen, and displays this on the built-in projection screen. On this screen there is usually a grid that can be rotated 360

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degrees so that the XY axis of the screen can be aligned with the straight edge of the engine part to check or measurement [3].

This projection screen displays the profile of the specimen and is enlarged for both ease of calculating linear measurements. An edge to check the specimen can line up with a box on the screen. From there, simple measurements can be taken for distance to other points. The typical method for lighting is by diascopic lighting, which is the illumination of the rear. This type of illumination also called illumination is transmitted when specimens and translucency can pass through. If the specimen is opaque, then the lamp will not go through, but will form the profile of the specimen. Measuring samples can be done on the projection screen. A profile projector may also have an episcopic illumination whose light is shining from above. This is useful in displaying internal areas that may need to be measured [3].

Profile projector works optically and mechanically (optic mechanically). Where the principle of optical work is by using the lens and projector and light both aimed at the measuring object. While the principle of mechanical work, namely by using sled (motor servo) aims to move the measuring object (desk motion) [3].

2.0 EXPERIMENTAL METHOD

Based on the PC-314-04 method published by the Center for Materials and Engineering Goods under the terms ASTM E-11 2004 standard, some preparations should be made before sieve calibration. The calibrated sieves are checked, then the equipment is cleaned of dirt and glued material. The standard gauge and its accessories are also cleaned. Measuring tool or test with standard tools in accordance with the conditions of temperature and humidity during calibration. Condition temperature 20 ± 5 ^{o}C and humidity 60 ± 5%. The measured portion and the measurement position are shown in Figures 1 and 2. The results of recording the temperature and humidity conditions are subsequently corrected to the actual values by looking at the standard correction of temperature and humidity.

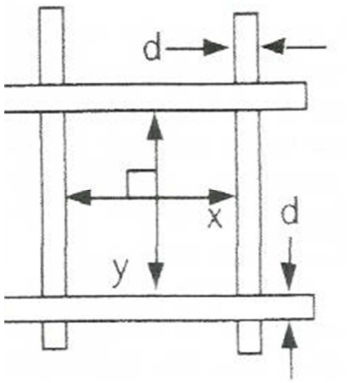

Figure 1: The measured part

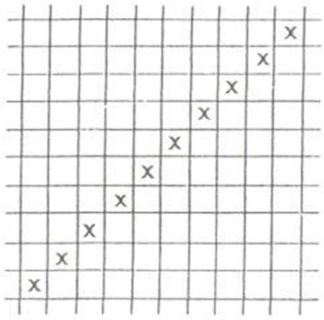

Figure 2: Position measured

The sieve is mounted on the projector profile projection glass shown in Figure 3.

Figure 3: Installation of sieves

Handle up and down directions are rotated to adjust the focus of the screen sieve. The x and y lines are on the screen indicator, so that the x and y lines are parallel to the screen sieve line. Determination of the starting point of observation is shown in Figure 4.

Figure 4: Starting point of observation

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3.0 RESULTS AND DISCUSSION

The results of the width opening observation are shown in Table 1.

Table 1: Measurement of width opening

No.	Width Opening	
	Y(µm)	X(µm)
1	827	910
2	841	889
3	836	913
4	821	878
5	824	909
6	849	874
7	849	919
8	855	876
9	825	916
10	883	894
Mean	869 µm	
Permissible variation	± 35	
Terms	815 µm – 885 µm	

Table 2: Measurement wire diameter

No.	Diameter of Wire	
	d_1(mm)	d_2(mm)
1	0.507	0.517
2	0.465	0.508
3	0.482	0.493
4	0.467	0.509
5	0.486	0.511
6	0.477	0.509
7	0.489	0.506
8	0.482	0.510
9	0.496	0.503
10	0.502	0.503
Mean	0.496 mm	
Permissible variation	± 0.075	
Terms	0.425 mm – 0.575 mm	

Table 3: Uncertainty Calculation Result

Uncertainty	Resolution Profile Projector	Mechanical response	Deviation Standard	Uc	U95
Width Opening (mm)	0.28868	0.57735	7.64282	7.90186	15.80
Diameter of Wire (mm)	0.00029	0.00058	0.00341	0.00798	0.02

From the data obtained, we get the graph deviation data against predetermined standards, graph deviation shown in Figure 5 and Figure 6.

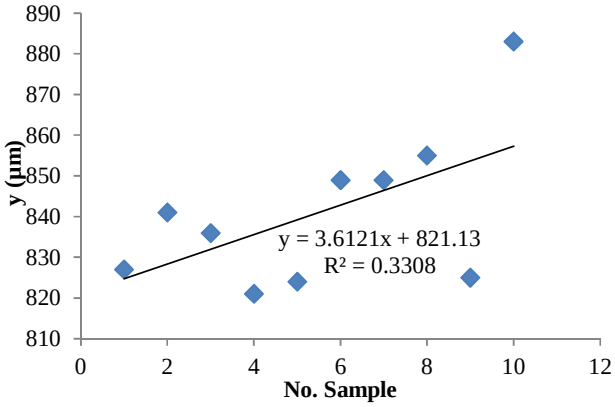

Figure 5: Graph of deviation Y

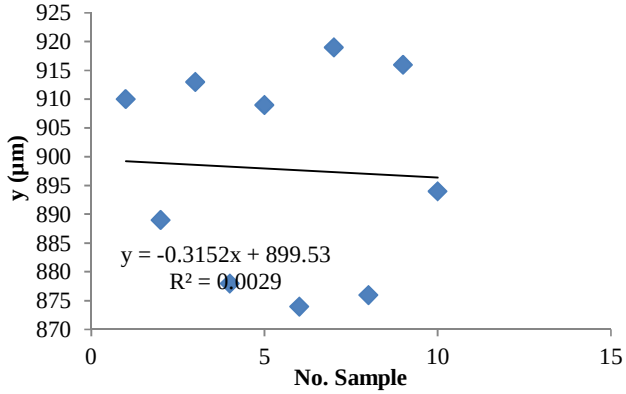

Figure 6: Graph of deviation X

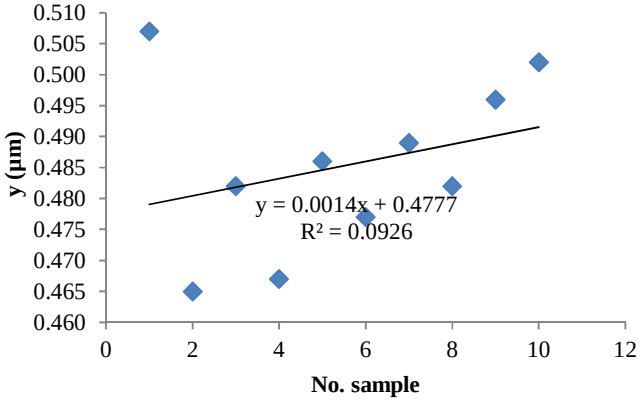

Figure 7: Graph of deviation d_1

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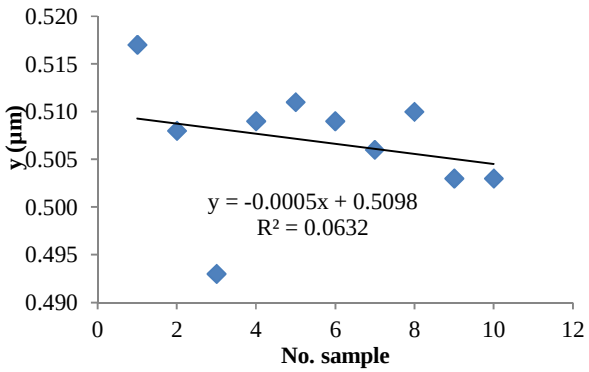

Figure 8: Graph of deviation d_2

The problem that often arises is calibration data is not always analyzed to make follow-up planning of the results, so that the next measurement results after the calibration process has not been adjusted with the calibration results obtained. From the sieve calibration result data then the data will be used to determine the deviation of the conventional truth of the value of the appointment of a measuring instrument, or the nominal dimension deviation that should be a measuring material, the resulting deviation value will indicate the quality of the measuring instrument, the smaller the deviation value the better the quality of the device measure it.

The results of measurements are influenced by factors such as the standard tools used, the treatment of the tools to be calibrated, calibration procedures, how to collect data, and the uncertainty of the measurement results. The measurement results shall include an estimate which describes how much error may occur, within reasonable limits of possibility.

Possible limiting values are obtained from uncertainty calculations, where the uncertainty values are influenced by standard tools used for screen calibration of Profile Projector No. 155, the influence of temperature during calibration, geometric influence when we calibrate the sieve with projector profile, readability of humans performing a sieve calibration, a standard deviation that is affected by repeatability or the ability of the reset tool to show a number at the same point. From the results of all calculations performed then we get the graph deviation on Y, X, d1, and d2. From the graphs obtained it can be seen how big the deviation value shown standard tool to sieve. The value of the deviation indicates whether the sieve still meets the standards used or not, this can be seen from the result of the uncertainty value that is still below the predefined standard value.

4.0 CONCLUSION

Based on this research, the conclusion of calibration data of sieving machine has been obtained. It was found that the sieving machine used in this research can be used to determine the size of sand grains used for construction. The uncertain value of the width opening sieve is 15.8 µm and the diameter of wire is 0.02 mm, so that the value of evaluation is lower than the allowed geometry deviation limit. Thus it can be concluded that the sieve machine is still within the permissible geometry tolerance limit.

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