Production of Electronic Mass Comparator with Load cell and Capacity of 1500 kg

Serhat TİGREL*, Sevda KAÇMAZ** and Ferhat TİGREL

** Esit Elektronik Sistemler İmalat ve Ticaret LTD.ŞTİ .Nişantepe Şile Yolu Pendik Ayrımı Paşaköy / Istanbul, Turkey*

*** TÜBİTAK, Ulusal Metroloji Enstitüsü (UME), P.K.21, 41407 Gebze/Kocaeli, Turkey*

Abstract

An electronic weighing instrument with a capacity of 1500 kg and resolution of 10 g were produced. The balance was designed with three high accuracy load cells and counter weights as 500 kg and 1000 kg. Also counter weights are used as reference standard for mass measurement. Standard deviation, linearity error and eccentricity error were measured for the weighing instrument.

1. Introduction

Different types of the weighing system to calibrate the masses are used as mostly mechanical balances (equal arm or single pan) and electronic balances with electromagnetic force compensation (EMFC) that have high metrological characteristics [1], but their capacity, scale interval and sensitivity (for mechanical equal arm or single pan) are limited. It is well known, for the construction of electronic balances are used one of the three main principles as strain gauge, vibrating string and electromagnetic force compensation (EMFC) [2].

The standard weights having a nominal value equal to or greater than 50 kg calibrated according to OIML R 47 recommendation [3] are used for testing (and adjusting) of high capacity weighing machines in accuracy classes III (medium) and IIII (ordinary). ESİT has been produced a mass comparator with strain gage load cell and capacity of 1500 kg for calibration of masses of 500 kg and 1000 kg used to verify high capacity weighing machines in accuracy class III (medium).

2. Structure

The principle of operation is illustrated in figure 1. The mass comparator consists of counter weights as reference standards and three load cells, mounted on shock absorber, on which is supported a set of three strain gage load cells. These shock absorbers have been designed to prevent the vertical loading axis to slide. A system of hydraulic actuator allows

either a reference or an unknown mass to be applied to the load cell.

Load cells of 5 kN having sensitivity of 2 mV/V were used for calibrating masses up to 1000 kg .

The substitution method can be use to be calibrate 500 kg weight and 1000 kg weight. The weighing and records are operated with manually.

The counter weights of 250 kg as reference mass were adjusted and calibrated with relative uncertainty of $2x10^{-6}$ (k=2.0, 95 %) by Mass Laboratory of UME (UME is National Metrology Institute, Turkey)

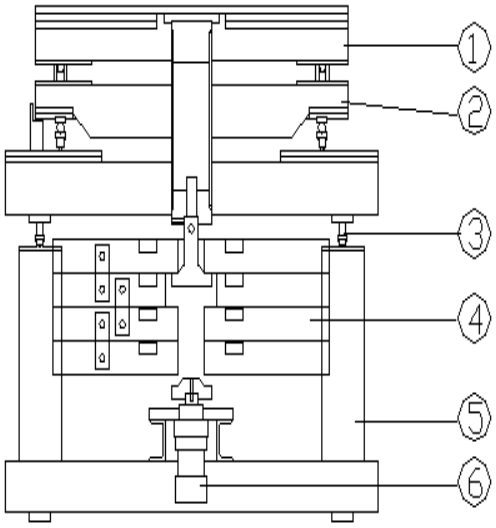

Figure1. Schematic diagram of the mass comparator. 1: top plate; 2: vibration absorber; 3: level adjustment bolts; 4: reference mass; 5: base; 6: hydraulic actuator

In figure 2, schematic diagram of the mass comparator looking from topside shows and in figure 3, photograph of mass comparator shows.

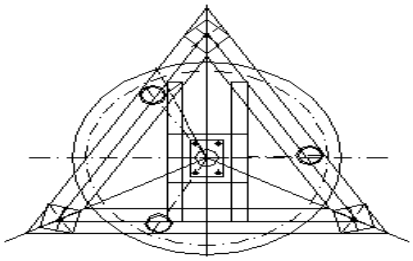

Figure 2. Schematic diagram of the mass comparator looking from topside

3. Verification of the Mass Comparator

The performance of the mass comparator was verified by applying of repeatability test, corner load test and linearity test. The repeatability test of balance was made using substitution method [4] as the difference between the ‘reference’ and ‘unknown’ is determined.

Test showed that the calculated standard deviation is 12 g up to 500 kg and 30 g up to 1000 kg under the laboratory conditions. Further applied test showed that the corner load error and linearity error were calculated as 10 g and 75 g.

4. Conclusions

An electronic mass comparator has been developed with load cell and capacity of 1500 kg to be calibrate masses of 500 kg and 1000 kg. The mass comparator can be use to calibrate the weights to better than relative

uncertainty of $5x10^{-5}$ as under the normal laboratory conditions.

Figure3. Photograph of mass comparator

5. References

[1]. Schwartz R., *Guide to massdetermination with high accuracy*, PTB –MA-40, Braunschweigh, 1995, 3-18.

[2]. Reber D., *Electrodynamic force compensation devices in mass comparators*, Proceedings of the 13th International Conference on Force and Mass Measurement, Helsinki- Finland, 1993, 205.

[3]. International Recommendation No:47 *Standard Weights for Testing of High Capacity Weighing Machines*, 1979.

[4]. Schwartz R., *Guide to mass determination with high accuracy*,PTB –MA-40, Braunschweigh, 1995, 20-22.

Contact Person for Paper:
Serhat TİGREL
Adress:
Esit Elektronik Sistemler İmalat ve Ticaret LTD.ŞTİ . Nişantepe Şile Yolu Pendik Ayrımı Paşaköy / Istanbul, Turkey
Fax:+90 0216 304 61 49
Tel: +90 0216 304 61 50
e-mail: serhatt@esit.com.tr