

Experiment No. 33

## 1. Aim :-

Verification of electronic weighing machine (N.A.)

## 2. Apparatus Used :-

- 1) The weighing test machine  $\frac{1}{2}$
- 2) Standard weights
- 3) Fractional weight box etc.

## 3. Theory :-

For non-automatic electronic weighing machine the classification and testing is based on OIML Recommendation rules 76 on the  $n^{\text{th}}$  schedule, Heading B of the SOW & m (General) Rules 1987.

- Error calculation :-

$$E = I + \frac{1}{2} e - \Delta - L$$

where  $E$  = error calculated $I$  = indication obtained from the display $e$  = verification scale interval, $\Delta$  = additional load needed to change the reading to the next higher value. $L$  = load on the pan.

- Error corrected :-

Error calculated - initial error

$$E_{\text{corrected}} = E_{\text{cal}} - E_{\text{ini}}$$

- Initial error  $E_{\text{ini}} = I + \frac{1}{2} e - \Delta - L$

\* Initial error

Ser. No.	Load on Pan (L)	I	AL	E <sub>initial</sub>
1	1 g	1 g	0.03 g	0.02 g

$$E_{ini} = I + \frac{1}{2}e - AL - L = 0.02 \text{ g}$$

Table - 1

Accuracy Test

Ser. No.	Load (L)	I	AL	E <sub>cal</sub> (g)	E <sub>corr</sub> (g)	MPE (g)	Remark
1	5 g	5 g	0.1 g	-0.05	-0.07	±0.05 g	(B/L)
2	500 g	500 g	0.05 g	0	-0.02	±0.05 g	(W/L)
3	2000 g	198.8 g	0.03 g	-11.48	-11.50	±0.1 g	(B/L)
4	3000 g	2957 g	0.03 g	-42.98	43.00	±0.15 g	(B/L)
5	6100 g	6066.4 g	0.06 g	-33.61	33.63	±0.15 g	(B/L)
6	3000 g	2956 g	0.04 g	-43.99	44.01	±0.15 g	(B/L)
7	2000 g	1988 g	0.03 g	-11.48	11.50	±0.1 g	(B/L)
8	1000 g	1000 g	0.02 g	0.03	0.01	±0.1 g	(W/L)
9	500 g	500 g	0.04 g	0.01	-0.01	±0.05 g	(W/L)
10	5 g	5 g	0.1 g	0.04	0.02	±0.05 g	(W/L)

Calculations:

$$E_{calculated} = I + \frac{1}{2}e - AL - L$$

$$= 5 + 0.05 - 0.1 - 5$$

$$E_{cal} = -0.05$$

$$E_{corrected} = E_{cal} - E_{ini}$$

$$= -0.05 - 0.02$$

$$E_{corr} = 0.07 \text{ g}$$

Table - 2  
Eccentricity Test.  $\frac{1}{3}$ rd of maximum capacity.

Sr. No.	Load on Run	Position of load	I	AL	E <sub>cal</sub>	E <sub>cor</sub>	MPE	Remark
1	2033g	C	2032.8	0.1	-0.25	0.27	±0.15	B/L
2	2033g	A	2032.8	0.1	-0.25	0.27	↓	B/L
3	2033g	B	2032.8	0.08	-0.23	0.25		B/L
4	2033g	D	2032.7	0.07	-0.22	0.24		B/L
5	2033g	E	2032.7	0.06	-0.21	0.23		B/L
6	2033g	C	2032.7	0.07	-0.22	0.24		B/L
7	2033g	Centre	2032.8	0.07	-0.22	0.24		B/L

Calculations:

$$E_{cal} = I + \frac{1}{2}e - AL - L$$

$$= 2032.8 + 0.05 - 0.1 - 2033 = \boxed{-0.25g}$$

$$E_{cor} = E_{cal} - E_{lw}$$

$$= -0.25 - 0.02 = \boxed{0.27g}$$

Table - 3  
Discrimination Test.

Sr. No.	Load on Run + 1e	I <sub>1</sub>	AL bearing of load	Add 1/10e	Extra load = 1.4e	I <sub>2</sub>	I <sub>2</sub> - I <sub>1</sub>	Remark
1	5g + 1e = 5.1g	5.1g	0.05g	0.01g	0.14g	5.2g	0.1g	W/L
2	3050 + 1e = 3050.1g	3018.3g	0.05g	0.01g	0.14g	3018.4g	0.1g	W/L
3	6100.1g	6066.4g	0.08g	0.01g	0.14g	6066.5g	0.1g	W/L

Calculations: -  $I_2 - I_1 = e$ , discrimination is OK.

$$= 5.2 - 5.1 = \boxed{0.1g}$$

## 4. Procedure :-

- (A) Accuracy Test :- Every machine is tested for its accuracy at a load equal to  $10e$  to determine initial error ( $E_{ini}$ ). Then the N.A.E.W.M  $1/4$  is tested at minimum, half and at full load to observe errors if any the corrected errors should be less than to the mPE.
- (B) Eccentricity Test :- The main object of this experiment is to determine if then the display change only due to the change of the load on the load receptor. This test is normally done at the load =  $\frac{1}{n-1}$  max. cap. where 'n' is the no. of supporting points of the load receptor.
- (C) Discrimination Test :- This test was performed at minimum half and full load of the scale  $1/4$ . In this test with the prescribed load i.e. load was taken in to pieces in terms of  $1/10e$  from this test we can get an idea about the verification scale interval (actual).
- (D) Repeatability Test :- This test was done at half and full load separately first. The initial error ( $E_{ini}$ ) was calculated. Formula used in this test is

$$(P_2 - P_1)_{max} - (P_2 - P_1)_{min} \leq mPE$$

Repeatability Test (at half load)

Sr. No.	Load on Pan (g)	I (g)	Add load AL <sub>1</sub>	P <sub>1</sub> (g)	Load on Pan (g)	I <sub>2</sub> (g)	AL <sub>2</sub> (g)	P <sub>2</sub> (g)	P <sub>2</sub> -P <sub>1</sub> (g)
1	1	1	0.07	0.98	3050	3051.1	0.05	3051.1	3050.12
2	1	1	0.07	0.98	3050	3051.1	0.06	3051.09	3050.12
3	1	1	0.06	0.99	3050	3051.2	0.05	3051.2	3050.27
4	1	1	0.07	0.98	3050	3051.1	0.04	3051.11	3050.13
5	1	1	0.05	1	3050	3051.1	0.06	3051.09	3050.09
6	1	1	0.07	0.98	3050	3051.1	0.05	3051.1	3050.12
7	1	1	0.07	0.98	3050	3051.1	0.05	3051.1	3050.12
8	1	1	0.06	0.99	3050	3051.1	0.05	3051.1	3050.11
9	1	1	0.07	0.98	3050	3051.1	0.06	3051.09	3050.11
10	1	1	0.06	0.99	3050	3051.1	0.06	3051.09	3050.1

$$(P_2 - P_1)_{\max} - (P_2 - P_1)_{\min} = 3050.27 - 3050.1 = 0.17$$

Table - 5

$$0.17 \approx 0.1 \text{ mPE (B/L)}$$

Repeatability Test (at full load)

Sr. No.	Load on Pan (g)	I (g)	Add load FL <sub>1</sub>	P <sub>1</sub> (g)	Load on Pan (g)	I <sub>2</sub> (g)	AL <sub>2</sub> (g)	P <sub>2</sub> (g)	P <sub>2</sub> -P <sub>1</sub> (g)
1	1	1	0.05	1	6100	6099.7	0.05	6099.7	6098.70
2	1	1	0.05	1	6100	6099.7	0.06	6099.69	6098.69
3	1	1	0.06	0.99	6100	6099.8	0.05	6099.8	6098.81
4	1	1	0.06	0.99	6100	6099.7	0.05	6099.7	6098.71
5	1	1	0.04	0.01	6100	6099.7	0.05	6099.69	6098.69
6	1	1	0.05	1	6100	6099.7	0.04	6099.71	6098.71
7	1	1	0.05	1	6100	6099.7	0.05	6099.7	6098.70
8	1	1	0.05	1	6100	6099.7	0.05	6099.7	6098.70
9	1	1	0.05	1	6100	6099.7	0.06	6099.69	6098.69
10	1	1	0.05	1	6100	6099.7	0.06	6099.69	6098.69

$$(P_2 - P_1)_{\max} - (P_2 - P_1)_{\min} = 6098.81 - 6098.69 = 0.12 = 0.12 \text{ (B/L)}$$

5. General Examination:-

- 1) Make - METTLER TOLEDO
- 2) max. capacity - 6100 g
- 3) min capacity - 5 g
- 4) e value - 0.1 g
- 5) model - P46002-5
- 6) machine no. - 1121503068
- 7) Type - N.A.E.W. machine
- 8) class - II

6. Result:-

As per standards of weights & measures (General) rules 1987, the error observed were beyond limit in accuracy test and eccentricity test, hence electronic weighing machine was rejected for the stamping.

7. Precautions:-

- 1) Before the experiment, start the machine was cleaned properly.
- 2) m/c was kept on well levelled table.
- 3) By adjusting the levelling screw the machine was made horizontal before the experiment.
- 4) Loading & unloading was done with due care.
- 5) whole experiment was done with full attention.