

Experiment No. 121 Aim:-

To verify a beam scale - class - C of swan neck type.

2 Apparatus used:-

- 1) 10 kg 2 nos. and 5 kg 2 nos. test weights
- 2) Fractional working standard weight base (1 mg to 100g)
- 3) Two identical chains with pan.
- 4) Stand for suspending the balance.
- 5) Dummy weight (commercial wt. & stone clips)

3 Theory and formula:-

Beam scales are equal arm weighing instrument. It is first lever, the mechanical advantage of 1. It has three knife edges two bearings, two pans and pointer is the centre facing upwards. Its working principle is as follows.

At equilibrium condition.

Load on left pan \times Load arm = weight on right pan \times Effort arm

If load arm = effort arm,

then load at left pan = weight on right pan

To verify a beam scale the following test is performed.

- 1) General Examination.

Swan Neck type beam scale of 10 kg class - C

1) zero load Test

Table I

Sr. No.	Load on Pan		Positions of pointer	Remark
	Left	Right		
1	0	0	Pointer was at mean position	equipped

Table II Repeatability / sticky test (at zero & full load)

Sr. No.	Load on Pan Left	Load on Pan Right	Positions of pointer	Remark
1	0	0	Pointer was at mean position	equipped
2	0 + GP	0	Pointer regained its original position	non-sticky
3	0	0 + GP	— do —	non-sticky
4	10 kg	10 kg	Pointer was not at its mean position	adjusted and equipped
5	10 kg + GP	10 kg	Pointer regained its original position	non-sticky
6	10 kg	10 kg + GP	— do —	non-sticky

Table - III

shift test (at half load) i.e. 5kg mPE = 10g.

Sr. No.	Load on Pan		Position of load		E ₀	E _p	Remark
	Left	Right	Left	Right			
1	5 kg	5 kg	C	C	-	$\frac{10}{2} = 5g$	Equipoised.
2	5 kg	5 kg	C	A	1g	5 kg	W/L
3	5 kg	5 kg	C	B	2g	5 kg	W/L
4	5 kg	5 kg	C	D	1g	5 kg	W/L
5	5 kg	5 kg	C	E	1g	5 kg	W/L
6	5 kg	5 kg	C	C	0	5g	equipoised
7	5 kg	5 kg	A	C	1g	5g	W/L
8	5 kg	5 kg	B	C	2g	5g	W/L
9	5 kg	5 kg	D	C	1g	5g	W/L
10	5 kg	5 kg	E	C	4g	5g	W/L
11	5 kg	5 kg	C	C	0	5g	W/L

- 2) Test at zero load
- 3) Repeatability test (at no load & full load)
- 4) Shift test.
- 5) Full load test
 - a) sensitivity test
 - b) maximum permissible error test due to inequality arm.

4. Physical observation :-

1) Denomination	-	10 kg
2) Class	-	C
3) Type	-	swan neck
4) Trade mark	-	RAYS
5) Material	-	M.S.
6) Visual defect	-	Nil.

5 Procedure :-

I] General Examination :- The beam scale U/V was examined to see whether it conforms to the specifications as per standards of weights & measures (General) rules, 1987.

II] Zero Load Test :- The beam scale with its chain & pans was equipoised at zero load and the result is given in the table - I

III] Repeatability Test :- After equipoised the beam scale at zero load, a gentle push

knife edge & bearing Test :- (at half load)

Sr. No	Load on Pan		Position of load		E ₀	E _p	Remark
	Left	Right	Left	Right			
1	5 kg	5 kg	N	N	-	5g	equipoised.
2	5 kg	5 kg	N	I	3g	5g	w/L
3	5 kg	5 kg	N	O	2g	5g	w/L
4	5 kg	5 kg	N	B	4g	5g	w/L
5	5 kg	5 kg	N	F	2g	5g	w/L
6	5 kg	5 kg	N	N	0	5g	equipoised
7	5 kg	5 kg	I	N	2g	5g	w/L
8	5 kg	5 kg	O	N	2g	5g	w/L
9	5 kg	5 kg	B	N	2g	5g	w/L
10	5 kg	5 kg	F	N	3g	5g	w/L
11	5 kg	5 kg	N	N	0	5g	w/L

on the right pan was applied & released immediately to see that pointer comes to its original position similar observation was followed applying gentle push on left pan again equipoising the beam scale at full load i.e. at 10 kg repeatability test was performed in the same. The result was given in table - II

IV] Shift Test (at half load) :- The beam scale was loaded to half of its capacity i.e. 5 kg & keeping the weights at the centres of the two pans, beam scale was equipoised, now keeping the load on the left pan at centre, the load on the right pan was shifted at forward position as shown in figure 1. (ABCD) which are $\frac{1}{3}$ of diameter distance from the centre. The error was observed similarly the test was repeated for the left pan. The result was given in table - III

V] Full load Test :-

a) Sensitiveness Test :- The beam scale was equipoised at full load. Now weight equal to the prescribed sensitiveness for 10 kg class - c beam scale i.e. 5g was put on right pan an appreciable deflection of the pointer was observed. Similar

Table - IV Sensitivity Test

Sr. No	Load on Pan		Deflection Position of Pointer	Remark
	left	Right		
1	10 kg	10 kg	-	equipoised
2	10 kg + 5g	10 kg	appreciable	sensitive
3	10 kg	10 kg + 5g	appreciable	sensitive

Table - V maximum error Test (at full load)

Sr. No.	Load on Pan		E_0	E_p	Remark
	left	right			
1	10 kg w_1	10 kg w_2	0	10 g	equipoised
2	w_2	w_1	0.5 g	10 g	w/L
3	w_1	w_2	5 g	10 g	w/L
4	w_2	w_1	1 g	10 g	w/L
5	w_1	w_2	1 g	10 g	w/L

observation was performed for the left pan. The result is given in table - IV

b) Error due to inequality of arm :-
The beam scale was equipoised at full load the including pan and chains were interchanged and the beam scale was equipoised by adding fractional weight (m) on the lighter pan. Error due to inequality of arms is $m/2$. This process was repeated again & result is given in table - V

6 Result :-

The result in respect of all tests related to the beam scale, found in accordance with the standards of weights & measures (General) rules, 1987 within limit. Hence the beam scale was accepted for stamping.

7 Precautions :-

Due care was taken to avoid any parallel error & personal injury.

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