

Modernisation of Bag Filling System

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Conventional bagging plants employ bagging scales with knife edge supported weigh beam systems. Accuracy of such system is $\pm 250\text{g}/50\text{ kg bag}$. The modernization of these machines with load cell based system improves the accuracy of system to less than $30\text{ g}/50\text{ kg bag}$. Load cell outputs linear milli volt (mv) signals proportional to the applied load with accuracy better than 0.03%. The modernization can be carried out online with in-house support. The article gives in detail the modernization of existing bag filling systems inexpensively to realize yearly recurring savings.

Bagging Scales of the past have knife-edge supported Weigh Beam (WB) systems. Weigh Beams one end carries a knife edge suspended weigh hopper (WH) and the other end a similarly suspended box containing 50kg weight. Realizable accuracy of such a system is $\pm 250\text{ g} / 50\text{ kg bag}$, because of the corrosive and dusty environment of most fertiliser, cement and similar plants. Plants usually set the machines on the positive side to escape the weights and measures department wrath and to build and preserve company's image by not putting under weight bags in the market, resulting in product giveaway of around two hundred fifty grams per bag. Low cost retrofit can save over Rs. 30 million yearly by reducing this giveaway to $< 30\text{ grams} / \text{bag}$ for 1500 T/d urea, complex fertiliser, cement and grain or other plants. Details follow:

Weighing Machines Modernisation : Weighing Machines Modernization involves **Load Cell (LC) Retrofit** in place of the problem and wear prone and low accuracy knife edge weighing system, Load Cell associated electronic read outs, modern Weigh Hopper Assembly (WHA **Figures 1 and 2**) to replace the old WHA.

Old systems' Radial Gate Assembly (RGA) consisting of full feed and dribble feed gates and their operating links and cylinders suffered far too many maintenance problems resulting in availabilities of 60-70% only. The maintenance costs and deploying a contractor for manual bag filling added to the woes. The relay logic / PLC logics were complex. Modern RGAs described later are free of these nuisance problems. So are the modern two cylinder operated clamps compared to the old single cylinder operated clamps.

Load Cells (LC): LC outputs linear milli volt (mv) signal proportional to the applied load with accuracy even better than 0.03%. Since bagging machine applications need accurate reading at $50\pm 200\text{ grams}$ only, LC pinpoint accuracy calibration is easy i.e. the weight variation of each bag would be around 5 grams only (**Figure 2**).

Weigh Hopper Assembly (WHA): suspended from Load Cell in place of weigh beam (WB) suspended WHA are simpler and use no knife edge supports. Because of absence of maintenance prone and accuracy reducing moving parts, LCs improve the weighing accuracy to $\pm 30\text{ grams}$ per 50 kg bags, against the $\pm 250\text{ grams}$ of the past and

associated annual financial drain to the tune of 3 crores for a 1500 t/d urea plant and other high capacity fertiliser and cement plants. The stresses induced on the LC because of tension or bending generates the electrical output. In addition, digital electronics process the LC output. Hence, unlike the mechanical system using numerous moving parts for indication also after the basic knife edge supported weigh platform, the LC system maintains the basic accuracy of 0.01% till the final readout without introducing further errors. In addition, the electronic circuit tare the empty WHA assembly weight after each discharge to compensate for its material deposit build up weight gain. Hence 80% give away reduction and thus elimination of Rs. Three crore annual financial drain is easy.

LC Retrofit Tasks (LRT): LRT for modernizing existing bagging scales is really simple and inexpensive. Most plants can handle the task with their crew or through a petty contractor under the supervision. Below listed are the tasks involved:

1) Remove and discard the existing Weigh Beam (WB), and dead weight box

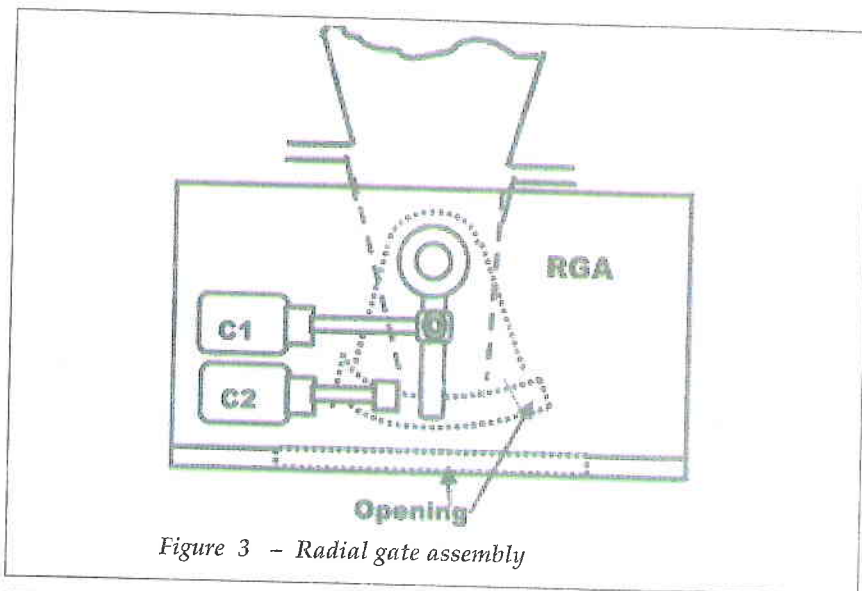


Figure 3 - Radial gate assembly

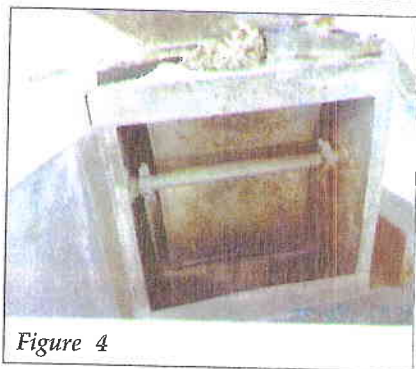


Figure 4

On feed signal from the circuit, the four way solenoid (FS) FS1 feeds air to the right side of swivel mounted Cylinder C1, the gate moves all the way to the left and

full feed starts. The LC senses 40 kg WH fill and using that the circuit feeds air to the left side of C1 and C2. Even though C1 tries to move the gate all the way to the right and close feed, the extended Piston Rod of C2 limits the travel to realize dribble feed. On 50 kg fill the circuit reverses air supply to C2 allowing full gate travel to close the feed, as C1 right side is still under pressure. Thus, just a very simple one gate system offers full feed to an empty WH, dribble feed at 40 kg WH fill, and feed cut off at 50 kg fill. Hence, weight variations of filled bag are < 30

grams per bag.

Weigh Scale Modernization Benefits Summary

1) Modernization eliminates excess weight giveaway; consequent savings run to > 1.5 crores yearly for a 1500 t/d urea plant; other plants too can realize similar savings.

2) It eliminates under weigh bag delivery to customers; thus saves customers' and weights and measures inspectors' wrath. In addition boosts company image.

3) High scales availability eliminates manual loading. Consequent savings run to additional Rs. 400000 to 500000 yearly.

4) Computer compatible Management Information System (MIS) from LC retrofit streamlines and integrates bag filling and accounting with the rest of the plant system and saves more.

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