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Energy Performance Improvement & Reduction in Manufacturing Cost Using Weighmetric Filler Unit in Paint Filling Line: A Modified Result Analysis

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Abstract : Energy conservation is the Focus area to fulfill the energy demand. The conventional energy sources are limited hence use of Non-conventional energy sources increased. The research Focus entirely to reduce Electrical consumption of Paint filling line. In india many industries are running overnight and every industry is working to save electricity consumption hence I have decided to focus on providing solution to paint filling line related to saving of Electricity. This research provide energy efficient solution to the Paint Filling line manufacturers. Under this research Paint filling line with Volumetric filler is studied and Electrical consumption in every unit is noted along with this construction and working of paint filling line and PLC logic of the line studied deeply. I have designed Paint filling line by using Weigh metric filler which reduces the compressed air consumption as well as manufacturing cost which ultimately reduction in Electricity without changing output of Paint filling line.

Keywords – Filter Unit, PLC, Paint Filling Line.

I. INTRODUCTION

The purpose of research to reduce the electrical consumption in paint filling line. In Paint filling line with the volumetric filler the material is sucked in syringe during suction stroke & deliver it into the container in compression stroke. Flow and quality of material to be dispense is being control by cutoff valve operated by Pneumatic cylinders. Instead of Volumetric filler if we use weigh metric filler then the compressed air consumption will be reduced hence reduction in electrical consumption is achieved. The details of both lines given below along with compressed air consumption which helps in selecting of Air compressor. Further to this costing of each line done & Mechanical, Electrical & Pneumatic cost of unit calculated and its observed that with new modification Manufacturing cost of unit will get reduced by 50% for the same output.

II. RESEARCH METHODOLOGY

While selecting this subject as a Project, one thing remain very important is to have conversation with the experts who are actually working in such industries and experiencing issues practically for years & who can guide us through their experienced perspective, so the idea of this project is conceived when I fortunately bumped into a person who is working in packaging industries then I did several survey at manufacturer place and through internet and I got more idea about construction and working of these type of firms. After Initial survey and through various literature studies, research methodology prepared. That is needed to follow for successful completion of this project.

1. **Understand the structure of paint packaging industries**
   - Theoretical survey of paint packaging companies existing in market
   - Selection of type of product for which we are going to do research (several type of products are being packed in these industries i.e. water base paint, solvent base paint, thinner and hardener etc.)
2. **Study construction and working of the packaging line for selected product. (design and construction of line is varies as per product)**
   - Selection of any one type of line which runs in industries on which desired modification for enhancement of energy efficiency can be done.
3. **Study and survey of electro- pneumatic system**
   - All the lines are operated electro -pneumatically so to do research on it, it is very important to understand basic working of electro -pneumatic system which consist of PLC, programing, panels, pneumatic components etc.
4. **Study and survey of Mechanical component manufacturing**
   - In automation mechanical components are actuated using electro- pneumatic system which consist of conveyors, filler unit, turn tables, pusher etc.
5. **Requirement of Mechanical Design change for the system**

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- Change in construction of existing conventional unit into modern energy efficient units

6. Requirement of Electro-pneumatic Design change for the system

- Change in Programmes as per new efficient unit

7. Estimation of reduction in energy consumption & overall cost.

III. PAINT FILLING LINE WITH VOLUMETRIC FILLER

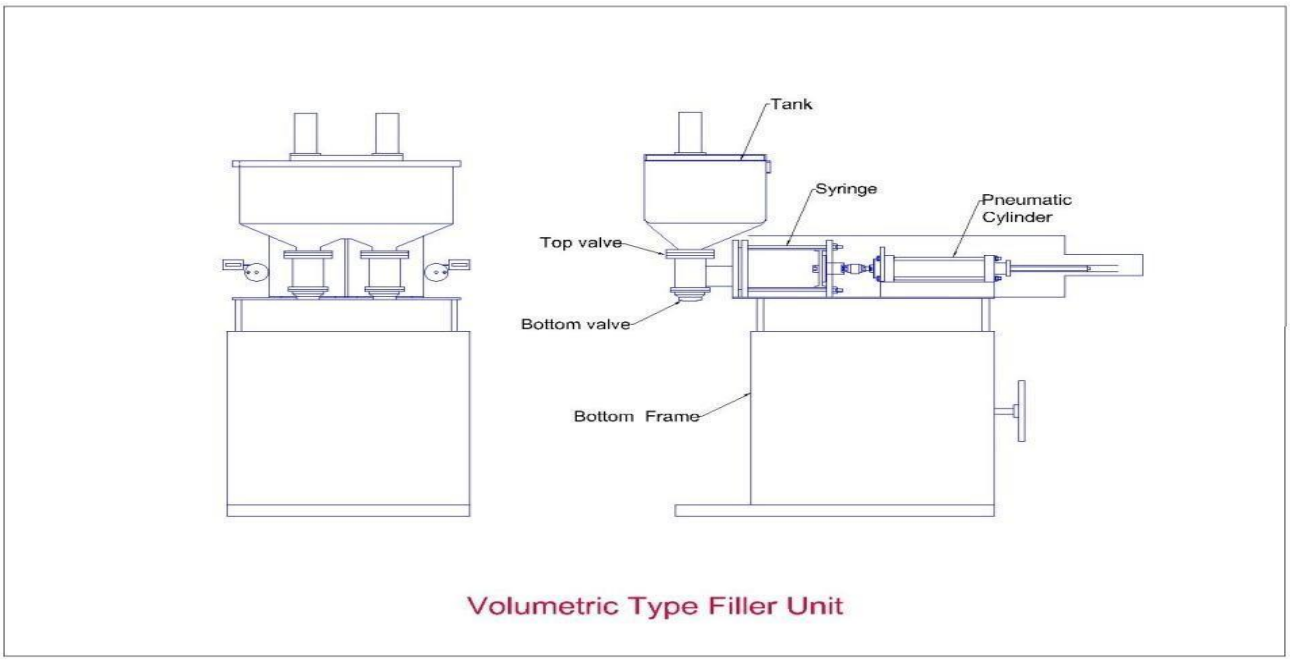

Fig No. 3.1 Paint filling line with volumetric filler

PAINT FILLING LINE WITH WEIGHMETRIC FILLER

In this type of filling material is poured by gravity. there is valve opening below tank which contains bowl on which ball seated.

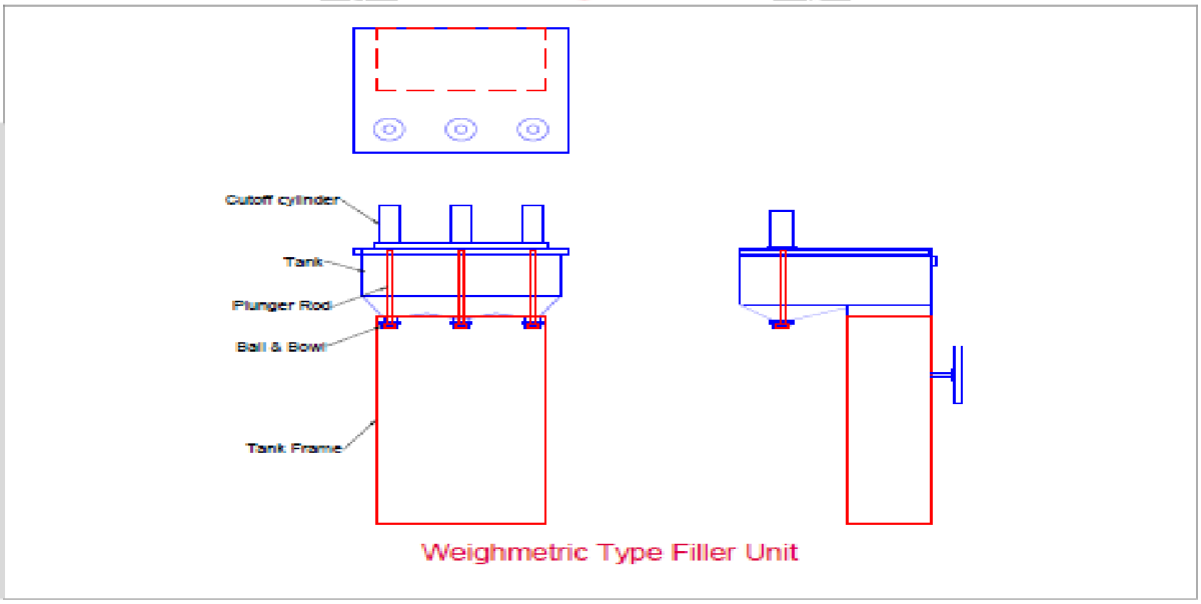

Fig No. 4.1 Paint filling line with weigh metric filler

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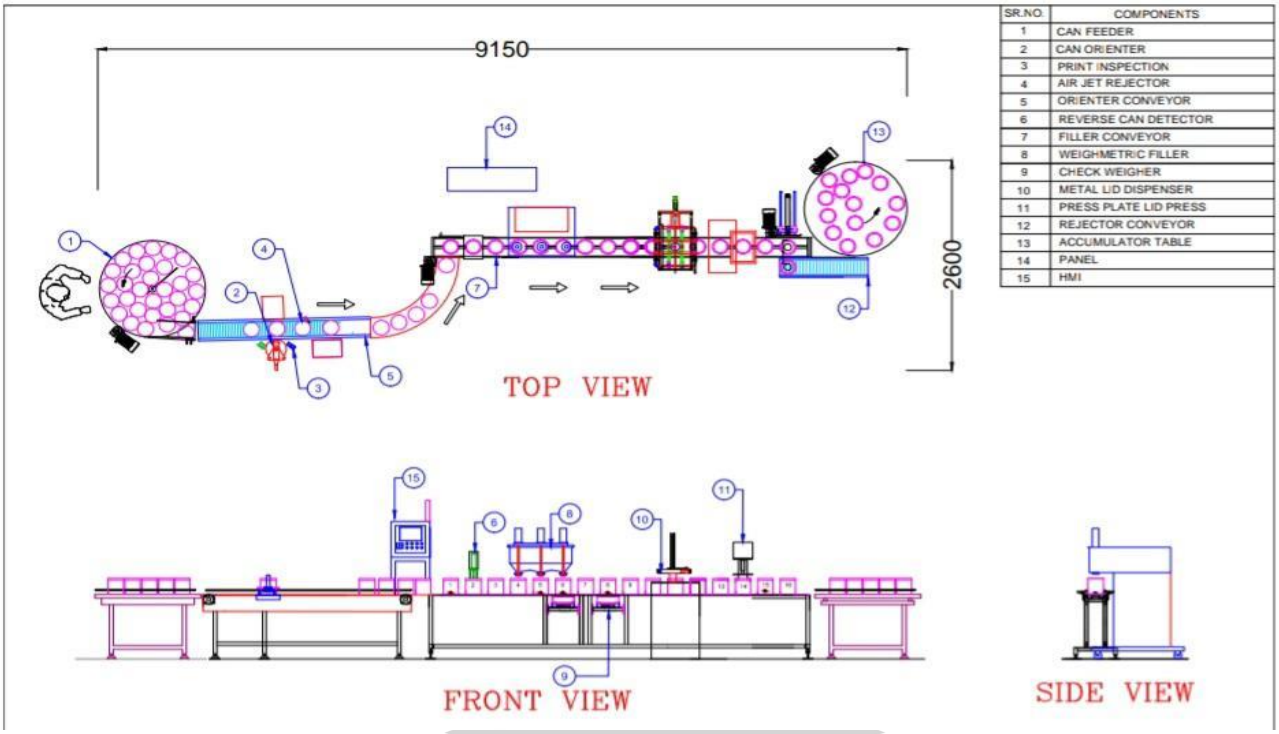

Fig No. 4.2 Fully automatic paint filling line with weigh metric filler

TOTAL AIR CONSUMPTION OF PNEUMATIC CYLINDER IN PAINT FILLING LINE WITH VOLUMETRIC FILLER

Sr No	Stations	Bore (mm)	Stroke (mm)	Rod dia (mm)	Air consumption / cycle (lit/min)
1	Orientor entry stopper	25	25	10	18.84
2	Orientor jaw cylinder	40	50	16	97.104
3	Reverse can detector	20	200	8	48.516
4	Volumetric filler	100	150	25	957.9
5	Upper cutoff cylinder	40	25	16	24.276
6	Lower cutoff cylinder	40	25	16	24.276
7	Dispenser Rotate	32	100	12	31.38
8	Dispenser place cylinder	25	40	10	15.168
9	Dispenser jaw	18	10	8	1.92
10	Dispenser jaw	18	5	8	0.96
11	Lid press	100	50	25	319.02
12	pusher	40	320	16	310.2
13	Dotting	32	100	12	62.4
				TOTAL	**1911.96**

Table No. 5.1 Total Air consumption of Pneumatic cylinder of Paint filling line with Volumetric Filler

TOTAL AIR CONSUMPTION OF PNEUMATIC CYLINDER IN PAINT FILLING LINE WITH WEIGHMETRIC FILTER

Sr no	Stations	Bore (mm)	Stroke (mm)	Rod Dia (mm)	Air consumption / cycle (lit/min)
1	Orientor entry stopper	25	25	10	18.84
2	Orientor jaw cylinder	40	50	16	97.104
3	Reverse can detector	20	200	8	48.516
4	Weighmetric filler cutoff 1	40	25	10	25.56

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5	Weighmetric filler cutoff 2	40	5	10	5.106
6	Dispenser	40	100	10	51.126
7	Lid press	100	50	25	319.02
8	Pusher	40	320	16	310.2
9	Dotting	32	100	12	62.4
				TOTAL	937.872

Table No. 6.1Total Air consumption of Pneumatic cylinder of Paint filling line with Weighmetric Filler

MANUFACTURING COST

SR NO	PAINT FILLING LINE	MECHANICAL	ELECTRICAL AND PNEUMATIC	TOTAL in RS
01	**Paint filling line with volumetric filler**	**837300**	**1102235**	**1939535**
02	**Paint filling line with weigh metric filler**	**548100**	**416042**	**964142**
			Total manufacturing cost saving (1-2)	**975393**

Table No. 7.1: Comparison of Manufacturing cost o between Paint filling line with Volumetric filler & Weighmetric Filler

IV. RESULT

Total Savings of Electrical power consumption

= Electrical power consumption of Existing Paint filling line - Electrical power consumption of Proposed paint filling line.

= 17.5 HP - 9 HP

= 8.5 HP

Total Saving of cost of electrical power consumption

Total annual Electrical consumption cost of saving of paint filling line

= Total annual electrical consumption cost of existing paint filling line - Total annual Electrical consumption cost of proposed paint filling line

= Rs. 8,70,300 - Rs.4,47,600

= Rs .4,22,700

Total saving of Manufacturing cost of unit

= (Mechanical , Electrical and pneumatic components cost of existing paint filling line) - (Mechanical , Electrical and pneumatic components cost of proposed paint filling line)

= Rs. 19,39,535 - Rs. 9,64,142

= Rs 9,75,393

V. CONCLUSION

With the help of above readings & calculation we can determine the electrical consumption of existing system. If we use inductive sensors to stop the unnecessary running of line due to the disturbances in filling line & during idle hours then we can save the electrical consumption of the line. For this we have to give logic to the PLC to stop the can feeders Instead of using existing volumetric filling system we can use weigh metric system which will reduce the air consumption & ultimately reduces the compressor power consumption. Weigh metric consist of load cell arrangement which detect the weight of filled can & automatically gets cut off if the required qty is filled in the can. After doing detail study on working of automatic lines used in packaging industries, I suppose that there are thousands types of automatic lines are running in packaging industries and thousand numbers of such conditions are generated from which tremendous amount of energy is being wasted. Hence, here I can discreetly conclude that by doing detail energy consumption study on every electro pneumatic operating system, we can minimize the energy consumption which can help lowering energy demand in that particular field which helps to supply energy in the rural area of our country where energy supply is still inadequate. The modification will reduce the compressed air consumption in cylinder which ultimately help in reducing the electrical consumption.After modification in the existing Paint filling line by using weighmetric unit the manufacturing cost & electrical consumption cost will reduce approximately by 45%.

VI. FUTURE SCOPE

Proposed line can be manufactured and executed in industries as a energy efficient device, considering all the

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salient features that are incorporated while restructuring it in order to make it cost effective and energy efficient as compare to existing line. Detail energy consumption study for such machines in automation industry is not being practiced for years, considering this scope I have taken interest in studying and executing of the project. Now all industries in India are marching towards fourth revolution (Industry 4.0) & technologies are adapted subsequently. This project is based on existing machines which were manufactured in industry3.0 revolution, so if we want to put full automation to the line and manufacture and run proposed line in (Industry 4.0) we need to do certain modification which only includes selection of standard electromechanical components with advanced technology suited for industry4.0 regardless of the design that we have proposed. For example: In current machine we have considered induction motor which does not give any feedback to the PLC for how much time it is running as well as in standby mode but in Industry 4.2 there are devices which can estimate the Motor run time and standby time, so here we can easily get the data of machine run time and energy consumption.

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