

# Result Analysis of Energy Saving in Filling Line of Paint Industry

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**ABSTRACT:** In this research paper the detail analysis of modified paint filling line is mentioned along with electrical consumption of each stations. Nowadays every industry is concern about the utility bills hence the paint filling lines should be made electric efficient during manufacturing stage only. This research includes solutions related to saving of electricity which is useful for every paint manufacturing industry those are using semi automatic machines for filling operation of paints. Many of the machines used in paint filling stations are supplied by the local vendors, and if the designers at vendor place forgot to take unwanted operation in account then it leads to wastage of electricity, in this research we have concentrated on those parameters which is ignored during the manufacturing of such machine. To refine our research, we visited to such companies those are suppliers of this kind of machines to the leading paint manufacturers, while discussing with the designers and engineers on shop floors who are involved during trial of such machines help us in innovating the energy efficient operation. This paper present scope to apply energy saving methods for paint filling machines so that overall consumption in manufacturing plant will reduce. With the help of continuous improvement & innovations, awarness towards understanding the concept of energy efficiency can full fill dreams of need of electricity in many parts of india.

**KEYWORDS:** programmable logic controller, paint filling lines ,energy efficiency

## I. INTRODUCTION

The paint manufacturing industry shown the consistant growth in the sector till date & with growing population & development in the nation there is tremendous opportunity lies in it. This paper include the result analysis of energy saving in filling line of paint industry. In this analysis various unwanted operations are studied and automation solution is provided for saving of electricity. During the study it was noticed, absence of feedback system in the line created the wastage of electricity in the line. This result analysis includes the detail energy consumption of each station of paint filling line. The operation of the filling of paint studied starting for entry of the empty can in the can feeder till the final packaging of the paints. Volumetric filler units are replaced with weighmetric fillers which results in huge energy saving. Sometimes customers may not knowing all the functions of the machine properly. In this case leading paint industry are the customers which are taking this lines during the plant set up but according to us its designer job to get the feedback of machine from the customer place & do the continuous improvement to make the design more efficient so that the paint line manufacturer can withstand in the competitive market and provide energy efficient line to the customers. This result analysis is a attempt of continuous improvements and innovations done to redesign the entire line & will make the paint filling line as Energy efficient.

### 1.1 working of paint filling machines & Modifications

The feeling line of paint consist of vairious stations which includes empty can feeder stations this can feeders are driven by motor. During inspection of paint filling line at manufacturer place I have noticed, if there is spillage of can occurs during the filling line there is no such machenasim available to stop the feeding of the can feeder and all cans are accumulated in the accumulator and rotating continuously which results in wastage of power. The can feeders are running on 3 phase motor drive. To overcome such drawback we added inductive sensors which are capable of sensing the excess accumulation of the can in the accumulator and it will give signal to the can feeder to stop the unnecessary movements. This line are controlled by programmable logic controller hence any if want to do any modification in the

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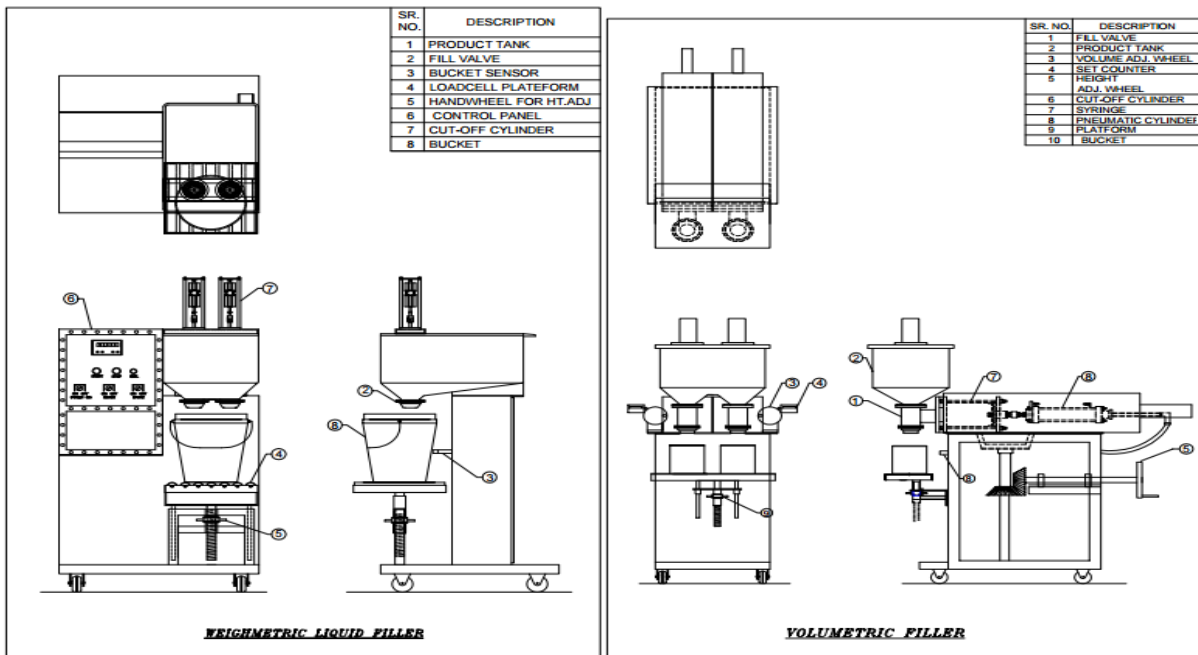
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system , we have to make necessary changes in the PLC. Before going to the accumulator cans are passing form the can orienter conveyor. This can orienter conveyor are running on 3 phase motor. The function of the can orienter conveyor is to detect the orientation of the cans properly for printing the necessary information in exact location. The can thus moves to the next station after printing towards the print detector camera which will check whether information such as price date and address are accurately printed or not.No print can rejector in the next station will detect can without printing, The printed can only allow in the next operations and all cans will reach in the intermediate table. The next operation is the paint filling operation which was earlier done by the volumetric filling but we modified this station with weighmetric station , which reduces the electrical consumption explained in details in the calculations below.



Fig 1.1 Paint filling Station



1.2 Weighmetric Liquid filler

1.3 Volumetric Filler

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## II. METHODOLOGY

- [A] Understand the operation of existing paint filling line
- [B] Record specification of each equipment in automatic liquid filling line
- [C] Calculation of power consumption of exiting automatic filling line
- [D] Modification in the existing system for reducing electrical consumption  
Addition of inductive sensor 2.Replacing volumetric filling by weigh metric filling to reduce air consumption
- [E] Modification in the programmable logic controller
- [F] Design calculation of energy saving
- [G] Costing and estimation

## III. RESULT ANALYSIS OF ENERGY SAVING

Indian paint industry is growing due to the great demand in housing, automobile etc sector. Asian paints, Berger paints etc enjoys market leadership in Indian paint industry hence there is great demand for research and development in the manufacturing processes of paint. With this project I am providing the modified energy efficient automatic liquid filling line which helps manufacturer to reduce the cost of the product.

### Step 1: Recording specification of equipments involved.

PROJECT: AUTO RETAIL LINE					
SR. NO.	EQUIPMENT	MOTOR			
		TYPE	HP	Current Amp	
1	Can Feeder -1	FLP	0.25	0.31	
2	Can Feeder -2	FLP	0.25	0.31	
3	Can Orienter -1	STD	0.125(1/8)	0.155	
4	Can Orienter -2	STD	0.125(1/8)	0.155	
5	Can Orienter Conveyor -1	FLP	0.5	0.62	
6	Can Orienter Conveyor -2	FLP	0.5	0.62	
7	Intermediate Feed Table	FLP	0.25	0.31	
8	Dodging Conveyor with Servo	STD	2	8	
9	Can Accumulator	FLP	0.5	0.62	
			4.5 HP	11.1	

**Table 3.1 Motor specification**

### Step 2: calculation of electrical consumption per day

Running of liquid filling line: 5 hours per shift

**Power consumption per day** I (amp) : power in watts / 1.732x power factor x E ( Volts )

Power in watts (per hour) : 1.732 x 0.82 x 415 x 11.1

: 6542 watts

: 6.542 kW

Power consumption per shift (5 hours)

: 6.542 (KW per shift) x (5)

: 33 KWh

Power consumption per day : 33 KWh x 15 hours

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: 495 KWh

Electricity units: 1kwh = 1 unit

Total consumption of electricity unit : 495 units ---- (A)

### Step 3: If spillage occurs within line & if it is taking 30 minutes to clear

Power loss in watts (per 30 minute) : 1.732 x 0.82 x 415 x 11.1

Due to unnecessary movement Of can & intermediate feeder : 6542 watts / 2

: 3.271 Kw ---- (B)

**Estimated result: we have saved the power lost in spillage after modifcaion**

### Step 4 : Pneumatic calculation used of existing system

Calculation of air consumption: per day machine use time:15 hrs.

Formula:

$$Q = \pi/4 * (d1^2 - d2^2) * h * (P+1) * 10^{-6}$$

Q= Air consumption per cm stroke (l)

d1= piston diameter (mm)

d2= piston rod diameter (mm)

h= stroke (mm)

p= operating pressure, relative (bar)

For cylinder: **DZF-25-25** for size 25 mm & stroke length

Size	Stroke/Length	Op. Mode	Piston Rod (mm)	Pressure	Cycles	Air Consumption per Cycle	Air Consumption lit per Minute
25 mm	25 mm	double	10	6.00 bar	60.00/min	0.16	<b>9.48</b>
40 mm	50 mm	double	16	6.00 bar	60.00/min	0.81	<b>48.56</b>
20 mm	200 mm	double	8	6.00 bar	1.00/min	0.81	<b>0.81</b>
25 mm	200 mm	double	10	6.00 bar	30.00/min	1.26	<b>37.93</b>
40 mm	25 mm	double	16	6.00 bar	60.00/min	0.40	<b>24.28</b>
<b>100 mm</b>	<b>150 mm</b>	<b>double</b>	<b>25</b>	<b>6.00 bar</b>	<b>60.00/min</b>	<b>15.98</b>	<b>958.68</b>
25 mm	5 mm	double	10	6.00 bar	30.00/min	0.03	<b>0.95</b>
18 mm	10 mm	double	8	6.00 bar	60.00/min	0.03	<b>1.93</b>
18 mm	10 mm	double	8	6.00 bar	60.00/min	0.03	<b>1.93</b>
25 mm	40 mm	double	10	6.00 bar	30.00/min	0.25	<b>7.59</b>
32 mm	100 mm	double	12	6.00 bar	30.00/min	1.05	<b>31.40</b>
100 mm	25 mm	double	25	6.00 bar	30.00/min	2.66	<b>79.89</b>
63 mm	10 mm	double	20	6.00 bar	0.07/min	0.41	<b>0.03</b>
32 mm	100 mm	double	12	6.00 bar	30.00/min	1.05	<b>31.40</b>
40 mm	320 mm	double	16	6.00 bar	0.15/min	5.18	<b>0.78</b>
						Total	<b>1235.68</b>

**Table 3.2 Air consumption by cylinders**

### Forward stroke:

$$Q = \pi/4 * (d1^2 - d2^2) * h * (P+1) * 10^{-6}$$

$$= 3.14/4 * 25^2 * 25 * (6+1) * 10^{-6}$$

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$$Q = 85859.375 \times 10^{-6} = 0.085859 \text{ ltr}$$

**Reverse stroke:**

$$Q = \frac{\pi}{4} \times (d_1^2 - d_2^2) \times h \times (P+1) \times 10^{-6}$$

$$= 3.14/4 \times (25^2 - 10^2) \times 25 \times (6+1) \times 10^{-6}$$

$$Q = 72121.875 \times 10^{-6} = 0.072121875 \text{ ltr}$$

$$\text{Air consumption per cycle} = 0.085859 + 0.072121875 = 0.158 \text{ ltr}$$

$$\text{Air consumption per minute for 60 cycles} = 60 \times 0.158 = 9.48 \text{ ltr}$$

As per above calculation rest of cylinders we have calculated the air consumption

**Calculation of Power consumption for compressor**

Compressor capacity: 225 liters

Motor power: 7.5 kW

Air used in volumetric filling of pressure: 6 kg/cm<sup>2</sup>

Time req to fill the air = 2 min 40 sec

**Flow rate through compressor (CFM):**

Tank capacity (gallon) x 0.536 (formula factor) x gauge reading (psi)

$$\frac{\text{-----}}{\text{Time (sec)}}$$

$$= \frac{60.81 \times 0.536 \times 86.55}{\text{-----}}$$

$$= \frac{160}{\text{-----}}$$

$$= 17.6314 \text{ CFM}$$

$$1 \text{ lit /min} = 0.0353 \text{ CFM}$$

For 17 CFM flow rate of air we have required 7.5 kwh electrical consumption

Hence per day for 15 hrs total power consumption is 113 kwh = 113 units

$$\text{Total air consumption of entire system in CFM} = 1235.68 \times 0.0353$$

$$= 43.61 \text{ CFM}$$

Total power consumption will be for entire system is = 20kwh

Hence per day for 15 hrs total power consumption is 300 kwh = 300 units ..... (C)

In volumetric filling arrangement we need cylinder of size 100 mm and stroke length where the air consumption is high 958 lit /min approx 34 CFM

Total Power loss = 14 kwh

Hence per day for 15 hrs total power consumption is 210 kWh = 210 units ..... (D)

$$\text{Total power consumption per day} = \text{(A) + (C)}$$

$$= 495 + 300 \text{ Units}$$

$$= 795 \text{ units}$$

$$\text{Total power saving per day} = \text{(B) + (D)}$$

$$= 3.271 + 210 \text{ Units}$$

$$= 213.271 \text{ units}$$

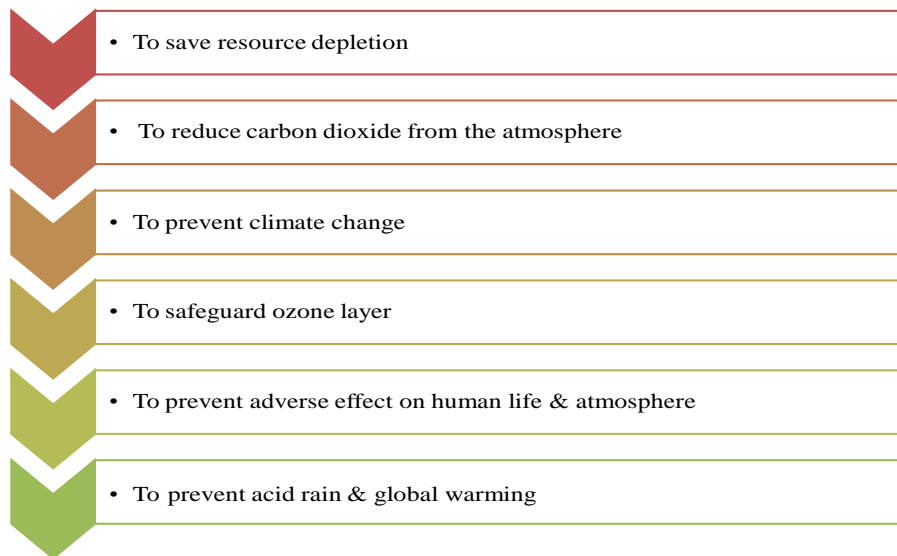
### IV. NEED AND OBJECTIVES

India needs huge amount of energy to grow in coming years. To push the recent government Make in India initiative will need more power sources. As we know we may try the option of energy production along with this we have to be conscious related to energy conservation & energy efficiency. Main objective of this project is to reduce the electrical consumption in manufacturing line. If we conserve & invent the energy conservation option in the existing system then ultimately we can reduce the energy production requirement and it help us achieve following.

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## V. CONCLUSION

This result of detailed analysis of paint manufacturing line were addressed to many leading paint industries which are using the paint filling lines form the local manufacturers & it is describes the potential in saving electricity. This result will address with the help of continuous improvement m,we can designed the energy efficient of equipment. In current scenario to fulfill demand of electricity this energy efficient approach in the manufacturing sector will play important role.

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