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Cycle time reduction in injection and extrusion blow moulding machine

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ABSTRACT

Reducing cycle time of injection and extrusion blow molding machines can help plastic moulding organization to meet the increasing demand of cutomers, this paper is an attempt towards reducing the machine and process cycle time using different aspects of methodology used and machinery.

Keywords: *HDPE- High density polyethylene*

1. PROBLEM STATEMENT

The company has an increasing demand in the production line of injection and blow moulding machines. 8.6 mm red caps and lubisol oil bottle (2 litres), needs to meet the increasing production count but is not able to cope up with the increasing demand which acts like a bottleneck.

2. OBJECTIVE

To reduce the cycle time of injection and blow moulding machines which produces 8.6 mm red caps and lubisol oil bottle (2 litres). Analysing whether there is any scope of improvement in the process currently used and thereby changing and stating the necessary betterment requirements to fulfil the increasing customer demand.

3. LITERATURE REVIEW

Understanding Takt time:
The rate to which a company needs to produce the product to satisfy the customer demand, or the maximum time available to produce a part.
It is calculated as,
Takt time= Net production time / customer demand per shift

Understanding Cycle time:
The time taken to complete a specific task from start to finish is called cycle time. In a nutshell, cycle time is the total elapsed time to move a unit of work from the beginning to the end of a physical process.
It is calculated as,
Cycle time= Net production time / number of units produced (available machining time / number of parts produced)

4. METHODOLOGY

1.1 Cycle time reduction in injection moulding machine (product- 8.6mm red caps)

Fig. 1: 8.6 mm red caps assembly

We have to do cycle time reduction in production of 8.6mm red caps (Material: HDPE

Grade: ACP 56331)
produced for two injection moulding machines (nova servo 125).
Monthly target= 30 lakh caps
i.e. per machine monthly target= 15 lakh caps
i.e. per machine per day target= 50k caps
Let's calculate takt time and cycle time simultaneously,

Takt time= Net production time / customer demand per shift

$$= \frac{24 \times 3600}{50000}$$

= 1.728

= 1.728 X 16 (for 16 caps)

= 27.65 seconds.

Cycle time of one cap produced = Net production time / actual number of units produced

$$= \frac{24 \times 3600}{45000}$$

= 1.92 seconds

= 1.92 X 16

(for 16 caps)

= 30.72 seconds.

Cycle time calculated using stopwatch= 30.30 seconds
Cycle time calculated of machine= 14.30 seconds
So, finally we have,

Takt time= 27.65 seconds
Cycle time= 30.72 seconds
i.e. Cycle time > Takt time

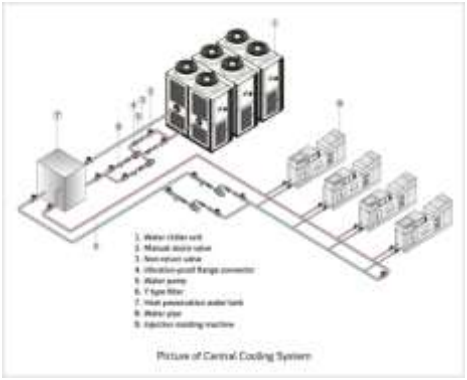
In order to fulfil the customer demand we need to make cycle time as close to takt time.

Solution:

- Currently the company is using normal water cooling system which is used to cool the final product inside the mould.
- This is a conventional technique being used and can be replaced by using water chillers with a very small investment.
- Installation of such chillers can reduce the overall cycle time to 3 seconds.
- The reduced cycle time is plotted in the graph and table given below.

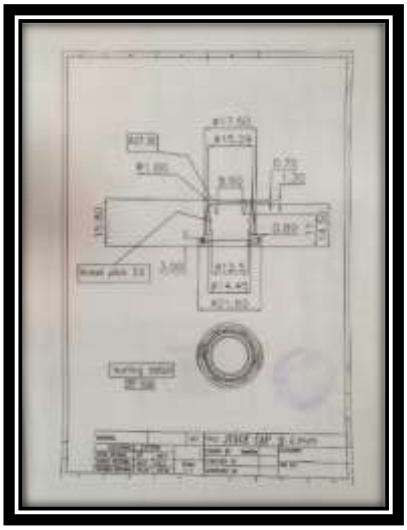
Fig. 2: Current Water cooling system

Fig. 3: Water chiller



Water chiller system
(Qty-2, chillers of 200 tons of capacity)

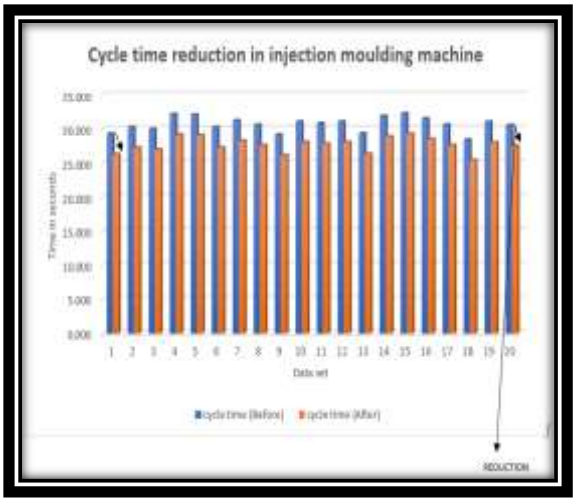
The piping system covers In and Out of the water flow from the injection moulding machine which acts as an endless flow cycle.



(8.6) mm red cap

Initial cycle time consist of 20 dataset values. Each value is calculated using stopwatch with the same worker performing the task from start to finish. The final product here is 8.6mm red cap.

Initial cycle time /Before (in seconds)	Final cycle time /After (in seconds)
29.302	26.302
30.274	27.274
29.979	26.979
32.185	29.185
32.099	29.099
30.269	27.269
31.260	28.260
30.630	27.630
29.178	26.178
31.081	28.081
30.847	27.847
31.084	28.084
29.361	26.361
31.923	28.923
32.291	29.291
31.548	28.548
30.648	27.648
28.424	25.424
31.053	28.053
30.546	27.546



Reduction of 3 seconds in every value of the dataset will occur after the installation of the water chiller, which in turn reduces the cycle time and makes the company work in an optimal working environment.

Cycle time reduction in Blow moulding machine (product- lubisol oil bottle (1 litres)

Lubisol oil bottle

We have to do cycle time reduction in production of lubisol oil bottle (Material: HDPE
Grade: F46003)
(1 litres) produced by one blow moulding machine (2000-H-2) (Mega machinery product)
Monthly target= 60k bottles
i.e. per day machine target= 2k bottles
Let's calculate takt time and cycle time simultaneously,

Takt time= Net production time / customer demand per shift

$$= \frac{24 \times 3600}{2000}$$

= 43.2 seconds.

Cycle time of bottle produced = Net production time / actual number of units produced

$$= \frac{24 \times 3600}{1500}$$

= 57.6 seconds.

Cycle time calculated using stopwatch= 55 seconds
Cycle time of machine= 24 seconds
So, finally we have,
Takt time= 43.2 seconds.
Cycle time= 57.6 seconds.
i.e. Cycle time > Takt time

In order to fulfil the customer demand we need to make cycle time as close to takt time.

Solution:

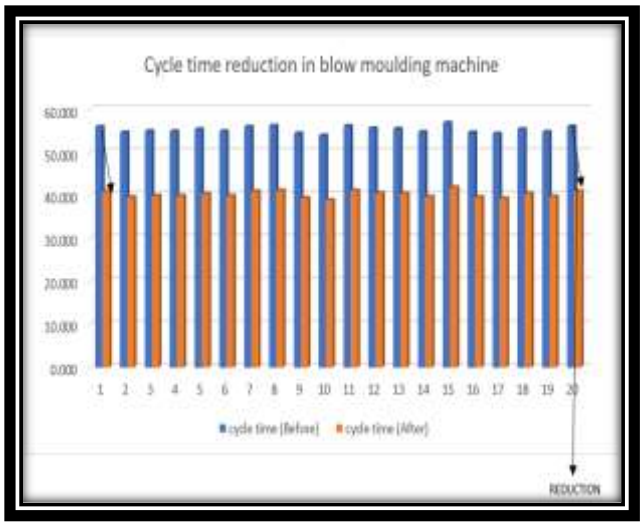
- Observing the current situation, one person has been doing ejection and finishing operation. The time required for finishing by one person takes a lot of time.
- However, if two workers are allotted the time is reduced by 10 seconds.

Currently the company is using normal water cooling system which is used to cool the final product inside the mould.

- This is a conventional technique being used and can be replaced by using water chillers with a very small investment.
- Installation of such chillers can reduce the overall cycle time to 5 seconds.
- These changes can reduce the overall cycle time to 10+5=15 seconds.
- The reduced cycle time is plotted in the graph and table given below

Initial cycle time consist of 20 dataset values. Each value is calculated using stopwatch with the same worker performing the task from start to finish. The final product here is lubisol oil bottle (1 litres) (black).

Initial cycle time /Before (in seconds)	Final cycle time /After (in seconds)
55.885	40.885
54.587	39.587
54.886	39.886
54.861	39.861
55.332	40.332
54.872	39.872
55.915	40.915
56.138	41.138
54.375	39.375
53.870	38.870
56.089	41.089
55.521	40.521
55.448	40.448
54.680	39.680
56.834	41.834
54.588	39.588
54.286	39.286
55.374	40.374
54.720	39.720
55.950	40.950



Reduction of 15 seconds in every value of the dataset will occur after the installation of the water chiller and proper delegation of the manual finishing operation, which in turn reduces the cycle time and makes the company work in an optimal working environment.

5. CONCLUSION

When we implement the above solutions the overall efficiency of the company can be enhanced and can lead us through maximum customer satisfaction.

6. REFERENCES

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