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Set-up Time Reduction of a Triple offset valve using SMED Technique

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Abstract - *As per the increase in demand, the industries need to increase their flexibility and hence increase the production. So, for an increase in the production the smaller batch size concept is used. Hence, it will increase the setup time. Therefore, quick setup processes involving small batch sizes and greater flexibility are a need of an hour. This paper aims to focus on SMED which is, Single Minute Exchange of Die along with Lean Manufacturing process in production industries. This paper explains the concepts of applications SMED with the method for a reduction of setup time for TOV. By using some extra tools such as kaizen, 5S and standard work procedures, reduce bin setup time of the tov is possible. Thus, the process setup time was significantly lowered (from 76 to 13 minutes). The percentage reduction for the set-up time of the TOV is 82.89%.*

Keywords: Overall equipment effectiveness (OEE), Triple offset valve (TOV), Single Minute Exchange of Die (SMED), Internal and external activity, Time Study, Cycle time.

1. INTRODUCTION

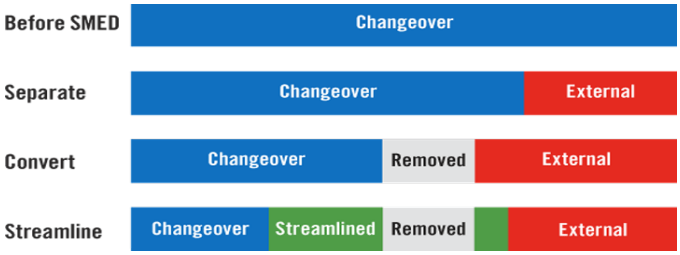
Manufacturing triple offset valve body in been carried out on the Trevisan machine. As the setup time for the body is high which will ultimately affect the production rate, by the use of SMED technique, the internal and external activities have been changed and the setup of the body is been change i.e., over single body setup double body is been mounted. Hence, in the time of single body setup duel body setup is provided.

1.1 What is SMED?

Single-minute exchange of die (SMED) is one of the many lean production methods for reducing waste in a manufacturing process. It provides a rapid and efficient way of converting a manufacturing process from running the current product to running the next product.

SMED Process Steps:

1. Identify Pilot Area
2. Identify Elements
3. Separate External Elements
4. Convert Internal Elements to External
5. Streamline Remaining Elements



1.2 Lean Production Facility layout

The creation office format is as significant as the innovation it houses and significantly affects business execution. The format must be adjusted and

Improved consistently. At exactly that point can the waste related with a poor design be wiped out or decreased. All things considered, change to the current format is infrequently mulled over when making arrangements for creation upgrades. Rather the attention is on procedure, materials and the format is frequently out of degree.

2. DISCUSSION

We have reviewed all machine losses, then we found a maximum set up time is 130hrs on DS-450 TOV Trevisan machine (Last 5 months' data). So we have selected DS-450 machine for SMED, started the SMED activity in Feb 2nd week 2019 & successfully completed on March. 2nd week 2019. On SAFOP machine the maintenance losses are increased month to months, so we will start TPM activity on the same for a smooth running of the machine without losses. Eliminate / simplify the external activities.

3. LITERATURE RESEARCH

Vinod Raj, M .Rajesh in (2017) reduce lead time in manufacturing process of CNC machine by lean principles. Rushikesh Gavali, Shrikant Chavan in (2016) reduce setup time of a manufacturing line using SMED Technique. Kaustubh Patki, Akash Phuge, Yayatee Patil (2016) reduce machining time of trim die of Automobile panel. Deepak kumar, Devanand (2017) investigated on cycle time reduction in production and implemented on the inventory

model in an Apparel industry. Pratik Ghodke, Vishesh Shah, Sani Asnain Mulla (2017) Implemented Heuristic Algorithm using Apache Spark having attribute reduction.

4. METHODOLOGY

- Data Collection and Analysis (Internal and External setup).
- Separating internal and external setup.
- Converting the internal setup to external setup & Improvements through kaizens.
- Streamlining all aspects of the setup operation.

4.1 Data Collection and Analysis

Data collection is done for Trevisan DS-450. An operation was used in this study to summaries and describe the data. After Studying the Production process flow identification of Triple offset valve, set-up time and standard operation procedure are reviewed briefly before setting up the data collection table is done. Based on the present production, data was collected and recorded on a daily basis. , it can clearly identify that the set-up time of the trevisan DS-450 is a Triple offset valve. Therefore to reduce the set-up time, Trevisan set-up time should be reduced. A detailed process study of setup on Trevisan machine is carried out. This contains activity number. Activity carried out, time required, internal and external activities are sorted. Table.1 below shows the detailed setup of TOV body.

Before

Fig- 1 Single Body Fixture

In the shown Fig 1, single body TOV mounted on the fixture. At a setup change time truing of fixture has to be done by dial stand for which angle fixture will be required. In this setup only one size is covered and to load a body two dowels are required. In this system clamps are not rigid and to maintain center distance dials and stand are incorporated in the setup. This system is less efficient because of setup change time and low speed.

Table -1: Cycle Time of Single Body Fixture

Sr No	Operation	CT in min
1	Fixture plate loading and Truing	35+40
2	Body Loading,Truing and Probing	20
3	Bottom side rough face milling (A Side)	6
4	Top side rough face milling (A Side)	8
5	Top Side Dia 50.8 through drilling (A Side)	5
6	Bottom Side Dia 50.8 through drilling (A Side)	4
7	Checking of CD from stem bor to flange face by dial .	20
8	Top Side gland Bore roughing (A Side)	15
9	Bottom Side Bore Roughing (A side)	8
10	Top Side Bearing Bore roughing (A Side)	6
11	Top Side finish face milling (A Side)	2
12	Bottom Side finish face milling (A Side)	1
13	Top Side gland bore Finish (A side)	32
14	Top Side Bearing Bore finish (A Side)	10
15	Bottom Side all bore finish (A Side)	21
16	Top Side dia 10.2 drilling (A Side)	2
17	Bottom Side dia 10.2 drilling (A Side)	2
18	Top Side dia 17.50 drilling (A Side)	4
19	Top Side dia 11.5 drilling (A side)	2
20	All drilling holes chamfer (A Side)	2
21	Top side Reaming dia 12 (A side)	11
22	Bottom and Top side tapping M12 (A side)	4
23	Top side tapping M20 (A side)	2
24	Cone side rib and ID finish(A side)	12
25	Cone Roughing (A side)	34
26	Cone finishing (A side)	35
27	Unloading	20
	Inspection	22
	Total time	**337 min**

Table -2: Cycle Time(CT) of Twin Body Fixture

Sr No	Operation	C.T. in mints
1	Fixture and Body Loading	35+40
2	Probing	5
3	Top side rough face milling (B Side)	4
4	Bottom side rough face milling (A Side)	3
5	Bottom side rough face milling (B Side)	3
6	Top side rough face milling (A Side)	4
7	Bottom Side Dia 50.8 through drilling (B Side)	3
8	Top Side Dia 50.8 through drilling (A Side)	5
9	Bottom Side Dia 50.8 through drilling (A Side)	3
10	Top Side Dia 50.8 through drilling (B Side)	5
11	Checking of C.D from stem bore to flange face by probing	4
12	Bottom Side Bore Roughing (B side)	5
13	Top Side gland Bore roughing (A Side)	10
14	Bottom Side Bore Roughing (A side)	6
15	Top Side gland Bore roughing (B Side)	10
16	Top Side Bearing Bore roughing (B Side)	4
17	Top Side Bearing Bore roughing (A Side)	4
18	Top Side finish face milling (A Side)	2
19	Bottom Side finish face milling (B Side)	1
20	Top Side finish face milling (B Side)	2
21	Bottom Side finish face milling (A Side)	1
22	Top Side gland bore Finish (A side)	19
23	Top Side gland bore Finish (B side)	8
24	Top Side Bearing Bore finish (B Side)	8
25	Top Side Bearing Bore finish (A Side)	12
26	Bottom Side all bore finish (A Side)	23
27	Bottom Side all bore finish (B Side)	2
28	Bottom Side dia 10.2 drilling (B Side)	2
29	Top Side dia 10.2 drilling (A Side)	2
30	Bottom Side dia 10.2 drilling (A Side)	2
31	Top Side dia 10.2 drilling (B Side)	2
32	Top Side dia 17.50 drilling (B Side)	4
33	Top Side dia 17.50 drilling (A Side)	4
34	Top Side dia 11.5 drilling (A side)	2
35	Top Side dia 11.5 drilling (B side)	2
36	All drilling holes chamfer (A Side)	2
37	All drilling holes chamfer (B Side)	2
38	Top side Reaming dia 12 (A side)	11
39	Top side Reaming dia 12 (B side)	11
40	Unloading	20
41	Inspection	21
	Total	**233.9 mints**

After

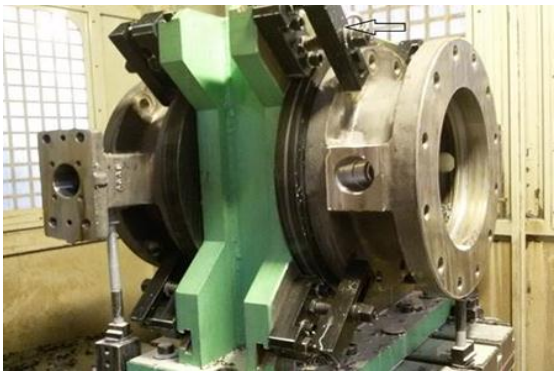


Fig- 2 Twin Body Fixture

In the shown Fig 1, Twin body TOV mounted on the fixture. In this setup there is no need to true fixture every time & no need of angle plate. Only one dowel is required for load body. In this fixture clamps are rigid & surface finish is improved. Setup change time is reduced as only plate has to change and no need to true fixture. Searching time for dowel, clamping studs, nuts & bolts are avoided.

5. COMPARISON

Sr.	Old Single Body Fixture	New Twin Body Fixture
1	At a set up change time, truing of fixture has to be done by dial stand.	No need to true fixture every time.
2	Angle plate is required to load fixture.	No need of angle plate.
3	On one fixture,only one size is covered.	All sizes from 8'' to 14'' are covered.
4	Two dowels are required to load a body.	Only one dowel is required for load dody.
5	ID location of body is not given.	ID location of body is given.
6	One body can be loaded at same time.	Two bodies are loaded at same time in same set up and thus waiting time for crane,helper and tool change are saved.
7	Clamps are not rigid.	Clamps are rigid.
8	To maintain center distance,dial and stand are used.	To maintain center distance,probing cycle is used to reduce cycle time.
9	Surface finish is poor due to vibration.	Surface finish is improved due to rigidity of fixture.
10	Low parameter(speed,feed) due to less rigidity.	High parameters(speed,feed,DOC) due to more rigidity.
11	Set up change time is more as every time we have to true fixture by dial stand.	Set up change time is reduced as only plate has to change and no need to true fixture.
12	More searching time for dowels,clamping studs,nuts and bolts.	Searching time for dowels,clamping studs,nuts and bolts are avoided..

6. RESULT

Activity	Set up time in mints
Current	76
Proposed	26
Actual	13

Table -3: Setup time reduction

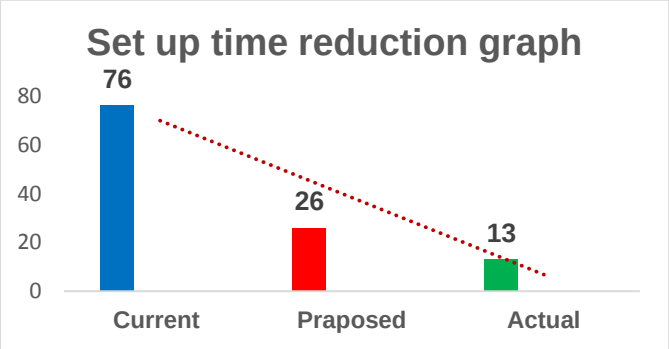


Fig- 3 Setup time reduction graph

Activity	Cycle Time in mins
Current	337
Proposed	296
Actual	233

Table -4: Cycle time reduction

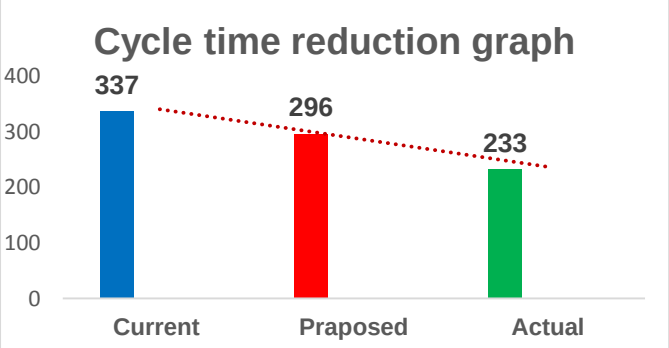


Fig- 4 Setup time reduction graph

7. CONCLUSIONS

After the implementation of SMED the reduction in setup time was achieve. SMED methodology was applied to prepare an optimum standard procedure for changeover operations. Achievements before and after the SMED implementation was made to measure the effectiveness of SMED to reduce setup time.

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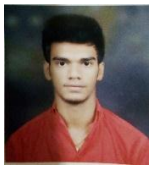
BIOGRAPHIES



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