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Research paper



Productivity Improvement and Cost Reduction in Hydraulic Cylinders

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Abstract

This paper is aimed to analyze the current status and processes carried out in production of hydraulic cylinders and to optimize the manufacturing methods to increase the production volumes and to reduce the cost of hydraulic cylinders. KAIZEN 10 step methodology is the tool used for improvement. Required data was retrieved from reports, daily logs and job sheets. Then it was analyzed to find bottlenecks in production lines and start working on solutions to improve productivity. Thus fluctuating customer requirements can be met and industries can sustain with competitor entries.

Keywords: *Cost reduction*; *Hydraulic Cylinder*; *Kaizen*; Loss; *Productivity.*

1. Introduction

1.1 Hydraulic Cylinder:

A double acting hydraulic cylinder is a cylinder in which the pressurized hydraulic fluid is used to move the pistons in the cylinder. A hole is provided in one end of the cylinder to connect the piston in cylinder to an external mechanism. The piston rod is fitted with gland to prevent the leakage of fluid to the other side. It has a port at the each end, filled with fluid for extension and retraction of piston. A hydraulic cylinder is an actuator used for applying unidirectional force through a unidirectional stroke.

1.2 Kaizen:

Kaizen is Japanese which means continuous improvement, word 'Kai', means 'Continuous' and 'Zen' means 'Improvement'. In business, kaizen means activities that continuously improve all functions. It is a long-term approach that systematically looks to achieve small changes in processes and to improve efficiency and quality.

1.3 Problem Background:

The main problem of production of hydraulic cylinder is low order from the client and due to the low order the work idle occurs. The cost of the production also increases. The cost of the cylinder is low in market compared to the procedure used to produce the cylinder.

2. Proposed Methodology

"Kaizen" 10 Step Methodology

1. Select the topic and type of loss
2. Organize the Focused Improvement group
3. Measure the current loss
4. Organize activities for the group and plan analysis steps
5. Specify improvement factors and set objectives
6. Analyze factors and set corrective & improvement actions
7. Implement improvement actions
8. Check and confirm effectiveness
9. Implement lock-up actions
10. Future actions.

STEP 1: Select Topic and Type of Loss:

Topic: productivity Improvement and cost reduction in Hydraulic cylinder.

Types of Loss:

The losses that are considered here are:

1. Financial loss
2. Idle hours of labours

STEP 2: Focused Improvement Group:

Based on the above flow chart and initial research, we have constrained to major specific department to continue further observation.

Technology Department:

- Document Preparation
- Document flow process
- Material flow Process
- Work balance

Production Department:

- Manual operation – (Disassembly & Assembly)
- Verification Process
- Material flow and Logistic
- Employer Skill

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- Employer Presence and Engagement

STEP 3: Current Loss Management:

List of Losses:

- Low orders from client.
- Idle hours of the labors, because of low orders.
- Financial loss – (material and operational cost)

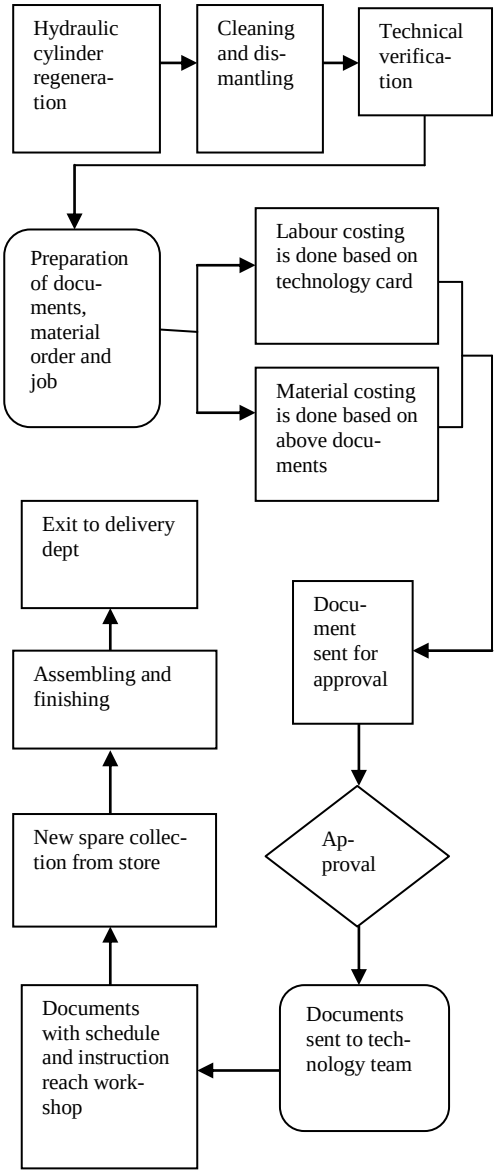


Fig. 1: Flow Order

STEP 4: Organize Activities for the Group and Plan Analysis Steps:

Based on the loss measurement from step 3, It is known that low orders is one of the key reason, directly impact efficiency , service cost and idle time , delivery time which is also consider to be major loss on this project

In order to reduce this loss in a step by step manner on focusing sustainable solution for the problem, we have planned and perform a technical analysis at two major department involved.

STEP 5: Specify Improvement Factors and Set Objectives:

Technology Department:

1. Document Preparation - This include technical specification, standards, drawings and material used.
2. Document flow process - Flow of document at each step(material, production, client approval)
3. Work balance - This include total number of orders completed by technologist per month.
4. Equipment's &Tools - This include hardware and software being used for preparation.

Production Department: (Identified Factors)

1. Manual operation - This include Disassembly, Assembly, machining and cleaning
2. Verification process - Inspection on dissemble hydraulic cylinder
3. Material flow and Logistic - Client approval on material and material delivery.
4. Employer Presence - Employer presence on the work shop for hydraulic cylinder orders.

Step 6: Analyze Factors and Set Corrective and Improvement Actions:

Parts selected for deep analysis are as follows:

S.No.	Part Name	Image	Tech No.	Rece-ived	Time Hr: Min
1	Cylinder Sleeves		322474	1	50.9
2	Piston Rod		322478	2	92.46

Step 6.1: Proposed Improvement for Cylinder Sleeves:

For technology card no 322474 given timings: 50:09 (Hr:Min)

S.No.	Proposed Im-provement	List of actions can be eliminated	Given tech-nology time Hr: Min
1	Buying pipe available in mar-ket, will reduce certain operation	Turning Op 1	23:30
		Inner-Surface Finishing (Honing)	10:30
		Turning Operation 4	13:12
Total time saving		46:12	

Based on cost:

S.No.	Action / Task	List of action cost	Calculated Cost (Rs.)
1	Cost with respect to existing plan	Forging	158906
		Turning	23014
		Honing	15705
		Turning	12614
Current Total Price			210239

Pipe price available in market: Rs 102153 (New Proposal)
Savings from the above proposed improvement
= Rs 108086

Step 6.2: Propose Improvement For Piston Rods:

Total time given (Hr: Min) = 92:46

S.No.	Proposed im-provement	List of actions can be eliminated	Given time Hr:Min
1	Buying heat	Cutting the rod	0:18

	Treated Rod without chroming coating (New Proposal)	(to specific length)	
		Smoothing– after cutting process	0:18
		Initial drilling	1:12
		Turning / Heat treatment	0:48
		Preparation for co-operation	0 :18
		Preparation for co-operation	0:54
		Cut a portion of rod	0:21
		Turning	18:0
		Heat treatment	15:06
Total saving			37:15

Cost Reduction:

Current Price

S.No.	List of action cost	Calculated Cost (Rs.)
1	Cost of rod	38650
2	Heat treatment cost	38135
3	Transport to heat treatment	15692
4	Quality check	30507
5	Chroming coating	59490
6	Transport to chroming coating	16970
7	Machining cost (manual op)	38096
Current Total price		238818

Price after Improvement

S.No.	List of action cost	Calculated cost (Rs.)
1	Cost of rod	51120
2	Chroming coating	59490
3	Transport to chroming	16970
4	Machining	38096
Total price With proposed improvement		**165676**

Savings = Rs.73142 per Unit

Step 6.3: Conclusion on Selected Jobs:

- ✓ Total time can be saved from new proposal (hr:min) – 83:27
- ✓ Total cost saving from new proposal for cylinder and piston rod of hydraulic cylinders
- ✓ Total cost saving = Rs. 181228

3. Conclusion and Summary

Kaizen 10 step methodology was successfully implemented and the total cost of hydraulic cylinder has been reduced drastically. The improved proposal is presented here. An update requires with current technologist work plan preparation, this will optimize overall timing for each operation, which leads to improvement in cost. These updates are possible only by standardizing some technical procedures.

Solution 1: Technical standards and grades
In our above selected BPCS the material grade 200-220 HB is selected for cylinder.
Key reason: Here,

- The cost of cylinder with grade 200 – 220 HB in market is low compared to our regular procedure to produce a cylinder.
- But the grade varies with each orders i.e. between from 200 – 360 HB – This has to technically verified.
- When we standardize the grade level to 220 HB, we can skip some major operations which are being done externally.
- Technical standardization also includes other area like, chroming coating, piston rod.

Solution 2: Specific clients

- Delay on client approval on costing
- This delays our delivery date and occupies our space at work shop.

Key reason: Here, we need to discuss with client to improve their approval speed. Or need to know the reason of delay

Solution 3:
Technical work Comparison has to done between our procedure of servicing and other marketers (internally AMP).
Key reason: Operational improvements (can reduce manual operation timing)

Solution 4:
Increase no of orders from client and find more clients. The implementation of above mentioned solution number 1, 3 and 4 will improve Efficiency.

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