Analysis of Design, And Value Engineering-Manual Flow Control Pneumatic Valve

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Abstract- *Success and failure of product in organization depends on customers satisfaction. Process of product development is key to success of product life cycle. Product life management is quite important for quality of work done during product design, manufacturing and value engineering. Effective optimization of design parameter and synchronization of value engineering during product development is salient point for success of organization. Specific industrial product examples taken for analysis and out are compared.*

Keywords- Product design, manufacturing process, value engineering, and product costing.

I. INTRODUCTION

In the field of engineering use of air as working fluid is very common. This is because of availability of air in quantity as well as quality. Application of air as working fluid can be done up to 5-10 bar pressure in regular use. Air is first pressurized by means of compressor or other device then pressured air can be utilized as per requirement of equipment or system. In case of precision and quality of work filter, regulator and lubricator (FRL) can be used for quality of incoming air. Prime concern is to control flow of air as per requisite. In case of pneumatic control of cylinders mainly electronic direction control valves are used with different configurations. In standard pneumatic system key elements are cylinder, directional control valve, flow control valves, pressure regulator, signal processing element. All element has its specific role in total system operation.

II. LITERATURE SURVEY

Ismail Ekmekci et al. [1] have discussed about use of TRIZ methodology and an application example with product development in details. In current business scenario where customer requirements changing rapidly with advent of technological innovation which also shortening product life cycle. Creative thinking to make unique product in standardized system based on known solution problem and unknown solution problems. When examining the patents Russian scientist Genrich Altshuller had found that contradictions can be eliminated with creativity. Based on research on TRIZ he finds basic of TRIZ methodology depends on contradictions, perfection, functionality and using resources. An algorithm based on TRIZ can be utilized with the help of ARIZ.

A.P. Shrotri et al. [2] have presented a comparative study Advanced Product Quality Planning (APQP) versus contemporary product design and development strategies for new product development. In traditional product development includes seven stage process namely idea generation, idea screening, idea development and testing, market testing, technical implementation, product launching and pricing apart from customer specific requirements.

Jan-Gunnar Persson [4] has discussed about current trend in product development by explaining different driving forces like technology, market, society. Synchronization of engineering design with deals with force, power, ergonomics with industrial design which deals with aesthetic, surface structure, semiotics, together help to attract customer. Iteration, integration and innovation apart from computer aided engineering (CAE), concurrent designs are also used to develop better product.

Simon Moritz Gohler et al. [5] have discussed about the translation between functional requirements and design parameter for robust design by using sub-functional requirement model. Proper analysis and implementation of effective tolerance in design can be used to reduce cost of product. In complex mechanical product consists of design, fluids, thermals, structural mechanics, etc. Computer Aided Tolerances are used geometrical requirements.

III. VALUE ANALYSIS TOOLS AND TECHNIQUES APPLIED ON PNEUMATIC MANUAL FLOW CONTROL VALVE

Fig 1: Flow control Valve

3.4.1 Functional analysis worksheet is prepared for the different parts of the product

Table 1: Functional analysis worksheet of Pneumatic Manual Flow Control Valve

Part Name	Sub-part/ Description	Qty	Function		Part		Assembly	
			Verb	Noun	Basic	Secondary	Basic	Secondary
Pneumatic Manual Flow Control Valve	Valve Body	1	Hold	Job	√		√	
	Spring Pin	1	Guide	Spring	√		√	
	Top Flat	1	Hold	Lever		√		√
	Bush	1	Sliding	Pin		√		√
	Lever	1	Pressing	O-ring	√			√
	O Ring	1	Flow	Air	√		√	
	Spring	1	Release	Energy		√		√

3.4.2 Costing of different units

Table 2 Costing of different units

Sr. No.	Unit	Part	Quantity	Total Cost in Rs.
A	Pneumatic Manual Flow Control Valve	Valve Body	1	610
B		Spring Pin	1	210
C		Top Flat	1	130
D		Bush	1	65
E		Lever	1	95
F		O Ring	1	10
G		Helical Spring	1	100
Total				1220

3.4.3 Functional Evaluation of each part is done

A	A3	A3	A3	A3	A2	A3	17	18
	B	B2	B2	B2	B2	B3	11	12
		C	C1	C1	C3	C2	7	8
			D	D1	D3	D2	6	7
				E	E2	E1	3	4
					F	F2	2	3
						G	0	1

Table 3 Functional Evaluation of each part is done

Unit	Key Letter	Part	Function	Weight	%Cost
Pneumatic Manual Flow Control Valve	A	Valve Body	Hold Job	18	50%
	B	Spring Pin	Guide Spring	12	17.21 %
	C	Top Flat	Hold Lever	8	10.65 %
	D	Bush	Sliding Pin	7	5.32%
	E	Lever	Pressing O-ring	4	7.78%
	F	O Ring	Flow Air	3	0.81%
	G	Spring	Release Energy	1	8.12%

IV. RESULTS AND DISCUSSION

Cost analysis of product component wise (Flow control valve manufacturing) in Indian Rupees.

Table 4 Cost sheet of Flow control Valve (PGWM0302)

Pneumatic Flow control Valve Manual							
SNo	**Component**	**Qty**	**Mat**	**R/M Cost**	**Process Cost**	**Cost/Unit**	**Total cost**
1	Valve Body	1	35C8	80	300	380	380
2	Spring Pin	1	En-9	10	80	90	90
3	Top Flat	1	35C8	30	60	90	90
4	Bush	1	GM	15	40	55	55
5	Lever	1	35C8	15	60	75	75
51	Helical Compression Spring	1	Spring Steel			30	30
52	O-Ring	1	NBR			10	10
Total cost							730

Product costing (in Indian Rupees) of **Pneumatic Flow Control Valve Manual**

Table 5 Product costing of Pneumatic Flow Control Valve

S No	**Activity**	**Cost**
1	Component Manufacturing Cost	730
2	Assembly cost	100
3	Painting Cost	50
4	Packing Cost	50
Total Cost		930

This result shows usefulness of value analysis in product manufacturing. The same procedure can be adapted during product design and will be useful tool for customer satisfaction.

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