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DEFECT PREVENTION SYSTEMS

A problem-solving team reduces variations in key product characteristic. Management supports the work. The team explains its work and results to workers inside and outside the company. Later, the area supervisor is replaced. The new supervisor doesn't understand the control charts and discontinues them. The problem recurs, and another team is assembled to solve it—again. Why did this happen?

Companies must do more than create problem analysis teams over and over again to solve the same problem over and over again. Sustained quality improvement needs an integrated quality management/defect prevention system.

Defect prevention systems comprise: process definition, process control, problem analysis, and continuous improvement.

THE CHARACTERISTIC MATRIX FOR A MACHINED PART

Operation	Part characteristic	Cut					
		OD 1	ID 2	Face 3	Dm. 4	Dm. 5	Dm. 6
Incoming material	Operation 05	X					
Operation 10-2	Cut ID	C	X				
10-3	Cut face	C		X			
Operation 20-4	Cut Dim. 4		C	L	X	•	•
20-5	Cut dim. 5		C	L	*	X	•
20-6	Cut dim. 6		C	L	*	*	X
Operation 30-1	Finish OD	X	C	L			

Key

X = operation output.

C = characteristic at an operation used for clamping.

L = characteristic at an operation used for locating.

* = characteristics created or changed by this operation.

• = interrelationship exists within an operation between characteristics due to common tools, generating heads, etc.

PROCESS FLOW DIAGRAM FOR A LATHE PROCESS

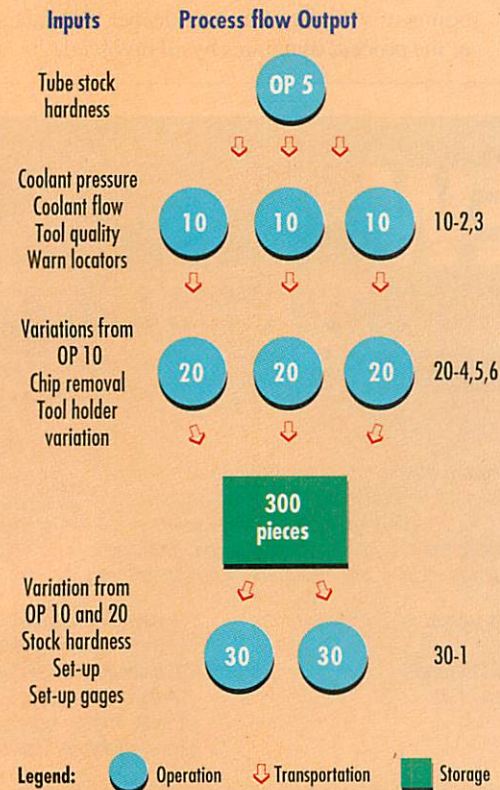


Figure 1.

Process definition

Process definition consists of a complete working definition of the process flow—critical product and process variables. It can be a flowchart or a list (Figure 1). Identifying product variables requires consideration of downstream operations. Identifying process variables comes from knowledgeable workers—seasoned machinists, for example—but later may be validated statistically.

Figure 2 shows the relationship between process flow and the product characteristics of a steel bar being turned to finish the inside and outside diameters and faced. Each product characteristic

is numbered by operation—each step in the process—and then sequentially. There are three process steps: Operation 10 cuts the ID and faces the end; operation 20 cuts three hub diameters; and operation 30 finishes the hub's OD. At each operation, the dimension or characteristic is numbered for easy identification and tracking.

Figure 2 is an example of a characteristic matrix for the machined part. The part is clamped on the OD at operation 10. The ID and short end face are cut (illustrated by the '*'). In operation 20, the part is clamped on the ID and is located on the short end face (dimension 3). Dimensions 4, 5, and 6 are cut at operation 20. At operation 30, the OD is finished.

Process control

A process control plan documents a process control strategy step-by-step. The plan includes part characteristics, end process parameters, level of importance, product and process specifications, measurement system, statistical control methods, sampling plan, process capability index, and the measurement precision. A process control plan summarizes and prioritizes each operation (Figure 3).

Problem analysis

Problem analysis defines, analyzes, and solves chronic problems. It includes: cause-and-effect diagrams to identify of potential causes, an action plan to collect data for cause identification, and data analysis to determine root causes. It is used by many successful companies.

For problem analysis to be effective over the long term, the solution must be integrated into the process control plan. But if such a plan does not exist, the solution may not last much longer than the life of the problem-solving team.

It's important to discriminate between continuous improvement and problem analysis. While continuous improvement uses most of the same tools and strategies of problem analysis, its aim is different—the reduction of variation around a meaningful target. Continuous im-

DIMENSIONAL CONTROL PLANS FOR MANUFACTURING OF A PRODUCT											
ID	Description	Type	Importance level	Control factors	Capability		Date	method	Control freq./size	Sample Gage type	
					Cp	Cpk					
1	OD	BP	3	M,S,T	1.5	2	10/2	X-bar & R	HR./5	air	
2	ID	IP	2	M,S,T	2	2	5/16	checksheet	.5HR./7	fix	
3	short end face	BP	2	M,S,T	1.33	1	12/5	X-bar & R	.5HR./10	laser	
4	dimension 4	FIP	2	M,P	3	1	10/24	X-bar & R	4HR./10	air	
5	dimension 5	IP	1	S				controlled by dimension 4			
6	dimension 6	IP	1	S				controlled by dimension 4			

<p>Key Type. Description of the process characteristic or dimension. IP = In-process characteristic or dimension. FIP = Final in-process characteristic. This dimension will not have any more modifications and is not a blueprint dimension. BP = Product engineering blueprint characteristic. This dimension is identified on the product engineering blueprint for this part. IBP = In-process part print. An in-process requirement to match a part print requirement.</p>	<p>Control factor. That factor which most influences the quality of the product. S = Set-up dominant. M = Machine dominant. O = Operator dominant. C = Component/material dominant. T = Tool dominant. P = Preventive maintenance dominant. F = Fixture/pallet dominant.</p>
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Figure 3. The dimensional control plan.

provement usually involves never-ending incremental change. The process control plan sets priorities and tracks continuous improvement efforts. And the capability index is used to prioritize and summarize continuous improvement efforts over time.

Defect prevention systems are critical for com-

panies striving for continuous improvement. Without a systematic approach, individual problem analysis and improvement efforts can be disorganized and suboptimal. Developing a defect prevention system requires coordinating different points of view, leading to a deeper understanding of the process dynamics by all involved. ■



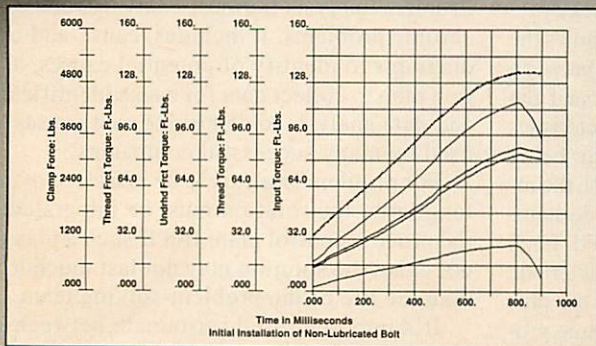
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