QUALITY ASSURANCE MATRIX IN AUTOMOTIVE INDUSTRY

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Abstract: This paper will present a very useful problem identification tool from automotive industry, the Quality Assurance Matrix. Quality Assurances Matrix is a standardized process that takes potential or actual Quality concerns, their importance to customer satisfaction and evaluates the robustness of the manufacturing and inspection processes against the potential or actual seriousness of the concern. This tool allows real positive impact on our customer satisfaction.

1. INTRODUCTION

Quality Assurance Matrix is an identification tool of the problems, and it isn't another problem solving tool. "Quality Assurance Matrix is a standardized process that takes potential or actual Quality concerns, ranks their importance to customer satisfaction and evaluates the robustness of the manufacturing and inspection processes against the potential or actual seriousness of the concern". Quality Assurance Matrix (QM) helps to achieve the goal of meeting Customer Quality Expectations such as:

1. QM enables control of all critical, significant and / or important items on the vehicle;
2. QM is a useful problem identification tool.

This tool is used for:

1. New Model Process Planning;
2. Current Model Quality Concerns.

Quality Mapping uses some of the Failure Modes and Effects Analysis (FMEA) thought processes – Risk Assessment. Ultimate aims of this tool are:

- Robust products and design;
- Robust manufacturing processes delivered through In-Station Process Control;
- Operator interface with process and product which assures quality of output;
- Engaging the intelligence of the total organization in pursuit of Customer Satisfaction.

2. UTILIZATION OF THE QUALITY ASSURANCE MATRIX

The quality assurance matrix is used (1), (3), (4):

a) As part of the new mechanical projects (new products and new industrialization)

In a way it synthesizes the default risk product / process taken into account during the construction of the control plan of the product for a manufacturing line.

It is part of the results expected in the borne of the project "Manufacturing Agreement". Its failure to achieve or incomplete implementation, and the value is not reached the level of guarantee, will be an unfavourable opinion from quality.

b) For serial production line

QM will be used, either in continuity with the implementation of a new product / process to the manufacturing agreement; or either to reduce the failure of a current manufacturing process. It will be chosen to implement a QM in the production line the most

defective, with the highest PPM (Parts per million). QA matrices can also be used by suppliers as a mean to target incoming PPM quality.

3. REALIZATION OF THE QUALITY ASSURANCE MATRIX

The matrix QM is established around the PDCA cycle (2), figure 1:

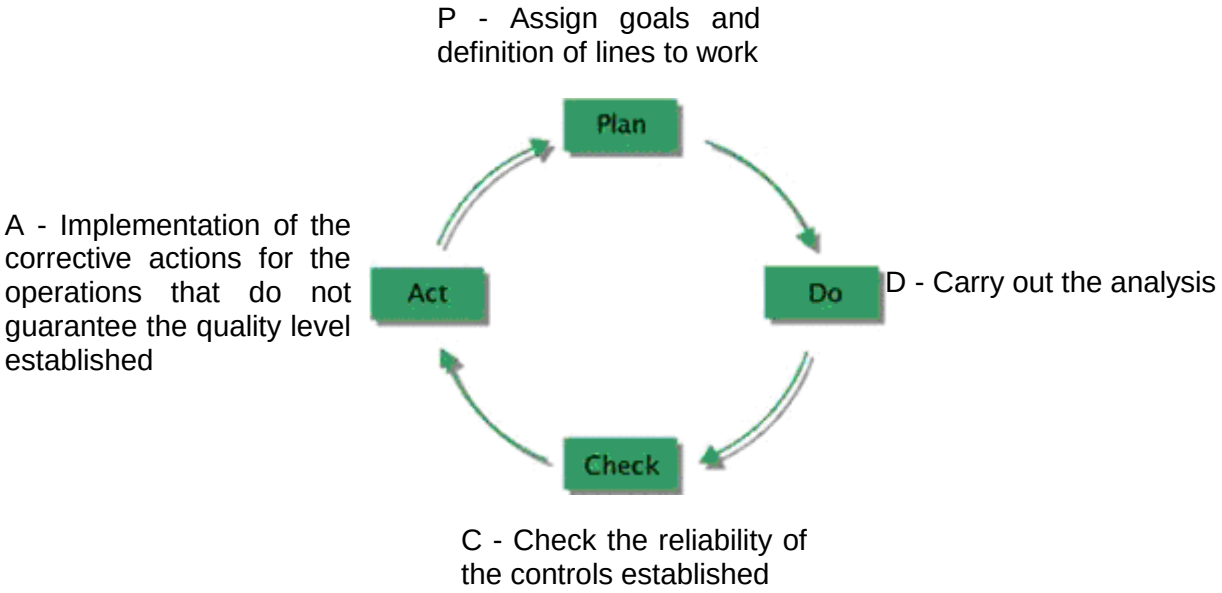

Figure 1. Quality Assurance Matrix and PDCA cycle

To realize the Quality Assurance Matrix we must work according to the following:

1. Selection of the working line

Fill in the header of the QM sheet by indicating the date of the first realization or its renewal.

2. Division of the process into operations

Based on the synoptic manufacturing, we have to document all the numbers of operations and their designations.

3. Definition of the causes of the failure and the influential parameters of the each operation.

For each of the operations described, identify the causes of the possible failure that could cause non-quality in the columns by separating the causes of product from the process causes called “influential parameters”. For this, we must rely on the experience of group members and QM existing historical data.

4. Evaluation of the importance level of the failure causes and the influential parameters

Each of the failure causes and the influential parameters associated can be valued on the following basis:

5. Documentation of the column IR / PVG

Document the values of RI (Risk Index) according to the influential parameters.

6. Search a history of failures

To build a complete QA matrix, look for, if possible, the existing information on the last 3 years for defects as similar products made in other processes.

7. Identification of the controls in the various operations of the process

It has to be identified for each workstation of the line analysed the cause of failure and influential parameters, the type of control used (visual, manual, automatic, anti-error etc.).

8. Setting the level of guarantee quality of product failure causes and each influent parameter

Enhance the quality assurance of each control for each product and cause of failure for each influential parameter.

9. Calculation the value of guaranteed quality of each cause of failure and influent parameter.

10. Documentation columns identifying defects (proven)

These are identified by a black point or a value, the number of defects recorded between two matrix QA reviews:

- Defects detected in the previous three months in the service network;
- Defects detected in the previous month in the process of assembling;
- Defects detected in the previous month in the process where we use the matrix QA.

11. Documentation of the column for observations

Noted in this column, all elements that can help improve the quality assurance process (e.g. for an incomplete weld defect, we can note: Beware of welding parameters).

12. Evaluation of the overall level of guaranteed quality of each cause of failure.

The evaluation of each cause of failure will be on the following mode:

- OK for a level considered good;
- NG (not guaranteed) for a level considered bad.

13. Calculation of the overall level of quality assurance of the line analyzed.

The overall percentage will be calculated using the following formula:

% Overall Level Guarantee Product/Process =

$$\frac{\sum \text{the values } (1,3 \text{ and } 5) \text{ of importance of the failure causes} + \text{influential parameters OK}}{\sum \text{all the values } (1,3 \text{ and } 5) \text{ of importance of the failure causes} + \text{influential parameters}} \times 100$$

Example of a Quality Assurance Matrix is presented in the figure 2 for a mechanical part from automotive industry.

4. REALIZATION OF THE QUALITY ASSURANCE MATRIX

There is a treatment of the changes of the guarantee level to assure a continuous improvement of this tool. The failure causes that do not or no longer reach the level set of quality assurance must be systematically addressed by actions to improve prioritized as follows:

- Incidents proven (first incidents UCM);
- Importance of the failure (A, B or C);
- Introduction of the limitation Poka-Yoke;
- Development of processing actions in the process fails, to lock or to control them.

The action plan decided in the workshop will be posted next to the matrix QA documented. It will include systematically the responsible assigned to each action, the deadline for completion and the expected impact on improving the level of security.

In permanence all the quality problems caused by the production line must be identified, studied and noted on the matrix according to QM:

- Customer problems (network) and problems in Body Plant

IMPORTANCE OF DEFECTS		
DEGREE	IMPACT CLIENT	Value
A	Serious	5
B	Very Annoying	3
C	Annoying	1

COTATION OF THE QUALITY CONTROLS MEANS	
COTATION	TYPES OF CONTROLES
⊙ 5 POINTS	* Automatical Control 100% * Impossibility of assembling or post machining * Interdiction / control Poka Yoke
○ 3 POINTS	* Warning POKA YOKE * Frequency Control(Mesurements) * Manual Control 100 % in line * Human Control 100% with identification
△ 1 POINT	* Frequency Control * Human Control 100% without identification * Periodic Audit * Humain Control 100% with or without identification

INITIALISATION	
DATE	
VISAS	
Resp.	
Quality Dept.	
Production Manager	
Team Leader	

Niveau global de garantie qualité

TEAM : 42,9%

Plant: 71,4%

Revision

Vehicle/Part	
Team	
Workshop	

N° of workstation	Designation process	Failure modes	Influential parameters	Importance	Antecedent	Risk	Control Process: TEAM 20	30	50		Retouche	Outside of TEAM: Control 1D	Control 3D	Final Contro			Quality Guarantee Value: TEAM	OUTSIDE OF TEAM	PLANT	Defects recorded: TEAM 1M	Hors UET 1M	CLIENT 3M	Level Quality Guarante: WORKSTATION	TEAM	Observations
OP20	Loading joints and BI + emmanchement BI																							
1		Wrong reference BI (L / RF)	Exchange operator	5			⊙										5	0	0				OK	OK	K
2		No clamping joint	Error of selecting value of effort (L / RF)	5			⊙										5	0	0				OK	OK	Connected to the detection of the diversity
3		Demanche Effort < specifications	Demanche Effort NC	5			⊙										5	0	0				OK	OK	Control 100%
4		Quotations 148,1 or 233,1 NC	Dirty nose fitting	3			△					○	○				1	6	0				NOK	OK	K
OP30	Ball Fitting																								
6		Quotations 14,8 or 14,3 NC	Dirty nose fitting	3			△					○	○				1	6	0				NOK	OK	K
OP50	Packaging																								
7		Expedition BI L in place of RF (or reverse)	Forgot to remove the label from the returned packaging	5										○			0	1	0				NOK	NOK	OK

Figure 2. Quality Assurance Matrix for a mechanical part from automotive industry

- Assembly (3 months).
- Problems in the process of assembling mechanical parts (the last months).
- The internal problems of the process (last month).

The matrix QA should be reviewed periodically. A monthly review is advised to obtain a good level of recognition of customer issues as well as effective monitoring of implementation of the proposed solutions. The revision of the matrix must be systematic to improve continuously the quality assurance objectives of the line production (closure of the PDCA cycle). The detection means established after analysis to control the quality of processes, must be revised if defects occur and involve the level of security established.

All controls introduced in the process after analysis by QM should be documented in the standard operation sheet and the operation process sheet for the position changed. This funding will allow the information constantly updated in the control plan. QM should be updated after any change processes, control system, or after any discovery of a defect or a new failure.

Every year, the goal of guaranteed quality level of each QM will be revised as part of the process for setting quality objectives for the following year. The manufacturer will be directly involved in continuous improvement to enhance the performance quality of its production line and ensure the quality of products delivered to customers.

5. CONCLUSIONS

The quality assurance matrix is based on the principle that any failure of a manufacturing process that affects a client must be eradicated. It is a tool to quantify the level of periodic quality assurance of production processes, to verify the reliability of the existing means of control in the process operations, to allow the implementation of anti-error (Poka - Yoke) or other locking devices to guarantee the quality delivered. Quality Assurance Matrix is used to prevent and to reduce significant the defects on the inner perimeter of the plant and also for the customer in the commercial network.

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