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**EVALUATION OF INTERNAL QUALITY  
AT MANUFACTURAL CORPORATION**

**Summary:** This work is focused on evaluation of internal quality in manufactural corporation. Huhn PressTech Ltd. is a company producing metal products as results of pressing process, construction units and other components used in automotive industry. The aim of the article is to review the process of internal quality evaluation method on daily basis. Constantly growing demand on metal chipless machining replaces the older chip`s technology. This paper aimed to clarify, how the company performs fault evaluation and what is done for their correction. To explain the procedure of evaluation in detail and demonstrate the solution, there were artificially made parts 3333 and 5555 in the company. The result is called Quality Alert.

**Key words:** pressing, internal quality, Quality Alert

## 1. INTRODUCTION

Huhn PressTech Ltd. is a subcompany of Heinrich HUHNS GmbH + Co. KG, German company. The group of Huhn is one from leading producers of metal shaped units and constructional components. It makes diverse sheet-metal dimensional components as self-sustaining components or constructional components used in different areas of industry. These components are mainly implemented in automobile industry and related supply chain.

The company was established in 1912 in Dieringhause by Heinrich Huhn. He took a machine shop over and established the foundation of the company on steel products with own manufactory workshop. Later, the company started producing iron-plated pressing components for bikes and motorcycles. Since 1936, the company has taken place in Drolshage and it has blossom into the modern company intended on shaping techniques and metal formed parts. Currently, HUHNS employs over 400 employees.

By establishing of Slovak subcompany Huhn PressTech Ltd. in 1995 (Vráble, Slovakia), it has begun a new international era for HUHNS company. This affiliated company is geographically situated on the east of valuable location near by customers from Middle and Eastern Europe. Departments of the company are divided into the four sectors: leadership, producing, quality

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and maintaining. There are production lines types Raster 250t, Raster 400t, Raster 630t, Schuler SDT630, MW 800 in the workplace. There is an infrastructure for 9 transfer automatic pressing machines to 800 tons and for the length of the table up to 5 meters. The philosophy of the company Huhn PressTech Ltd. is „zero-fault“, in aspect of interpretation of internal quality. The aim of presented paper is to determine how the company interprets faultiness of products and how is the methodology for its correction to for future.

## 2. MATERIAL AND METHODS

The date code is an identification used for tracing of date of manufacturing and the shift which produced the product. The tracing of date code is as following: on the 1<sup>st</sup> and the 2<sup>nd</sup> place is the number of calendar week, the 3<sup>rd</sup> place means the shift (there are actually three shifts in the company) and the 4<sup>th</sup> place means the year of product manufacturing. At the beginning of the shift, the worker is commissioned for setting up the date code according to the Tables 1 and 2. Example of the date code (DK): 06DE – 06 calendar week, D – Tuesday, the 1<sup>st</sup> shift, E – the year 2015.

Table 1. Identification of the shift

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1. Shift	A	D	G	L	Q	U	X
2. Shift	B	E	J	N	R	V	Y
3. Shift	C	F	K	P	T	W	Z

Table 2. Identification of the year

2011	2012	2013	2014	2015	2016	2017	2018	2019
A	B	C	D	E	F	G	H	I

According to the date code, it is possible to find out the fault product, the shift which made it in and the worker who is responsible for its production. The company manages strict evidence of attendance and the analysis of workers working with specific pressing machines. There are always two workers working with pressing machine. A machine operator is the person who is responsible for setting up and running of pressing machine. The second responsible person is an assistant of operator who removes produced units from conveyor, provides the first control and moves finished units into storage. Operators are trained for mistakes detection during the first control through the Quality Alert (current mistakes of manufacturing). These are the results of interpretation of internal quality + catalogs of mistakes (all of known mistakes of the design). If the operator detects one of possible mistakes (Tab. 3), he marks the chalk troop by the red card and the chalk troop is controlled by 100% control, so called blocking procedure.

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Table 3. The mistakes of accessories

1	Accessories from merging
2	Burr
3	Deformation
4	Cracks
5	Scoring
6	Fingerprints
7	Contamination
8	Rust
9	Missing operation
10	Failure operation
11	Fault of material
12	Fault of surface

On the place of 100% control, a worker accomplishes in-depth control of every piece in the chalk troop and books the data into the system such as: the date of control, the name of operator, operation before 100% control, the number of palette before control, the date code, the type of mistake with the number of founded faulted pieces, also the information about marking of chalk troop by red card, the number of palette after control, number of checked units, subsidiary information. Example of electronic report can be seen on Table 4.

Table 4. Electronic report of 100% control

Date	Operator		Operation after	No. of storage before control	Date code	Fault	Card	Fault on card	No. of storage after control	No. of checked units	Note
25.3.2015	Halenár	-	pressing	44444	12E E	Cracks	10	Red	44445	360	packaging
25.3.2015	-	Halenár	pressing	55555	12E E		0	None	55556	360	packaging

Workers of 100 % control have to also fill in the evidence of income and outgo at the workplace. They have to manually fill in the information about the name of product, the number of product, the number of checked units, the number of faulted pieces, the day of control and signature of operator. Example of income and outgo evidence can be seen on Table 5.

Table 5. Evidence of income and outgo at the workplace of 100% control

Income of 100% control			Outgo 100% control		
Name	Number	Amount	Produced	Reclaim	Scrap metal
Cover	7803	1099	960		139

Products are made on transferred and processed machines. On transfer machines, there are units moved along the transfer on production line type Raster 630t. The example of a big unit is in Fig. 1. The small pieces, such as

control lever or cable support, are made by processed machines. The example of a small piece is in Fig. 2.



Fig. 1. Cover



Fig. 2. Control lever

## 2.1. Method for evaluation of internal quality

Method for evaluation of internal quality is divided into the six steps:

### 1<sup>st</sup> step: Capturing data from production

It is necessary to be units produced in required day copied to the tables of production to evaluate *ppm tables*. It is needed to distinguish units made of aluminum, steel or if it is just a small piece (control levers etc.) The *ppm* (parts per million) is the way how to express fraction by means of a full number, similarly as percents. For example, 85 ppm expresses  $0.000085$  ( $85 \cdot 10^{-6}$ ) that means 0.0085%, so  $1\% = 10\,000$  ppm. In methodology for evaluation of internal quality, it is an indicator of faultiness. In the car industry, *ppm* is used to express quality of supply – how many faultily units were produced in 1 million of produced units.

It was chosen steel units from Table of production (Tab. 6) and copy to the Table of PPM STEEL. If it is not possible to define a material (aluminum/steel), it has to be found out the unit on the List of components (Fig. 3). It can be also searching on the drawing of specific unit where is written prescribed material.

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Table 6. Table of production

Name	Material	Pressing machine	Component	Date	Change	Order	Date code	Produced by	i.O	commotion			
Bed	Steel	MW800	2222	28.3.2015	1	1111111	09AE	Halenár	10026	0			
Bed	Steel	MW800	3333	28.3.2015	2	2222222	09BE	Halenár	4815	0			
Bed	Steel	MW800	4444	28.3.2015	2	3333333	09BE	Halenár	1417	20			
Cap	Steel	MW800	5555	28.3.2015	3	4444444	09CE	Halenár	7500	10			
Cap	Aluminum	MW800	6666	28.3.2015	1	5555555	09DE	Halenár	2780	0			
Adjustment	Detection	Burr	Deformation	Crack	Scoring	Fingerprints	Contamination	Rust	Failure Operation	Missing operation	Dimension	Cast	Red code
0												6986565	
0												5656565	yes
20												6256111	
0						10						6555555	yes
0												6565565	

Tool number	Storage place	Order	Step	Step in SAP	Equipment	Part	Part name	Material
111111		1	Trans. 1. 2. 3. 4.	444444	555555	02322-2222.1	Bed	Steel
9999		2	Trans. 1. 2. 3. 4.	666666	777777	02322-4444.1	Cap	Aluminu

Fig. 3. List of components

2<sup>nd</sup> step: Capturing data from 100% control

It is necessary to found out the type of units, the number of units, the kind of fault and the date code of units which were scraped from Electronic report of 100% control (Tab. 4). It is needed to use notes from Evidence of income and outgo at the workplace of 100% control (Tab. 5). Data are written to the Table of ppm production evaluation. It is very important to realize that the number of storage before control is different to the number of storage after control. It helps to better orientation in stock holding and faster searching for the components.

The Table of PPM is different for steel, aluminum and small pieces. It is divided to the three parts – the left side is the same for all of three parts. Here are just production data. On the right side of the table (Tab. 7), there are booked individual faults deducted from Electronic report of 100% control (Tab. 4). It is important to fill up the date for better searching. On the left side of the table (Tab. 9), there is red color at ppm because tables are adjusted to allowed number of faults. Whole table of middle part of PPM STEEL is on Table 8.

Table 7. Right side of the Table PPM STEEL

Date of control	Component	DK	Burr	Def.	Crack	Scoring	Finger-prints	Contamination	Rust	Failure o.	Missing o.	Dimension
	2222	09AE										
28.3.2015	3333	09BE			6							
	4444	09BE										
28.3.2015	5555	09CE					110					

Table 8. Middle part of the Table PPM STEEL

Produced	Burr	Def.	Crack	Scoring	Finger-prints	Contamination	Rust	Failure o.	Missing o.	Dimension	ppm per change
2592	0	0	0	0	0	0	0	0	0	0	0
4815	0	0	1246	0	0	0	0	0	0	0	1246
1417	0	0	0	0	0	0	0	0	0	0	0
7510	0	0	0	0	15979	0	0	0	0	0	15979

Table 9. Left side of the Table PPM STEEL

Name	Material	Pressing machine	Component	Date	Change	Order	Date code	Produced by	i.O	Commotion
Bed	Steel	MW800	2222	28.3.2015	1	1111111	09AE	Halenár	10026	0
Bed	Steel	MW800	3333	28.3.2015	2	2222222	09BE	Halenár	4815	0
Bed	Steel	MW800	4444	28.3.2015	2	3333333	09BE	Halenár	1417	20
Cap	Aluminum	MW800	5555	28.3.2015	3	4444444	09CE	Halenár	7500	10

Adjustment	Detection	Burr	Def.	Crack	Scoring	Finger-prints	Contamination	Rust	Failure o.	Missing o.	Dimension	Cast	Red code
0												6986565	
0												5656565	yes
20												6256111	
0						10						6555555	yes

There are marked parts on the table, in which the assistant of operator didn't find any fault on 3333 unit. However, from previous experiences, it had suspicion that it could be faulty. The unit was marked by red color and the chalk troop was transported to 100% control. In the chalk troop of 3333 units with the date code 09BE, there were found 6 faults (cracks) during 100% control. Operators reported electronic and written reports of the fault. The evaluation can be seen on Table 7. The operator found 10 faulty units of 5555 unit. The units were marked by red color and the chalk troop was transported to 100% control. In the chalk troop of 5555 units, there were found others 110 faulty units (scoring) during 100% control.

3<sup>rd</sup> step: PPM evaluation

The units, which exceeded predefined PPM fault limit, are highlighted by red color – Table 8.

Maximal permissible value of faultiness:

- crack – 2000 ppm,
- aluminum – 20 000 ppm,
- steel – 8000 ppm.

4<sup>th</sup> step: Internal quality

The highlighted part of the table 9 (3333 – cracks, 5555 – fingerprints) are necessary to report to the Table of internal quality (Fig. 4). It is written to the table – the number of the unit (3333), the fault of the unit (crack), the type of pressing machine (MW 800 t), the name of the unit (head), the date of producing (28.03.2015), the date code (09BE), the name of operator (Halenár), the numbers of produced units. There are also information if the Quality Alert (Quality report + Internal complaint) will be making out, link to automatic connection to the system and re-searching for Quality Alert.

Číslo výrobku / Teil No.	Foto	Typ chyby / Fehlerart	Lik / die Presse	Skupina výrobků / Teilgruppe	Datum výroby / Fertigstellungsdatum	Datumový kód / Kodierung	Aspovědný za výrobu / Verantwortlicher für Fertigung (Arbeitsführer)	Podstatná množství / suspektu Fertigungsmenge	Počet nahodných částí / Anzahl von MO Teilen	Poznámka / Notiz	Link
3333		Trhliny	MW 800	Drh	28.3.2015	09BE	Halenár	576	6 (100% kontrola)	Výsleduje sa QA - interná reklamácia	<a href="#">https://www.mercedes-benz.com/.../3333</a>
5555		Prstovky	MW 800	Vah	28.3.2015	09CF	Halenár	9 167	10 (FE) + 110 (100% kontrola)	Nevýsleduje sa QA - nasledujúci DK verejnosti	333

Fig. 4. Table of internal quality

5<sup>th</sup> step: Photo Documentation of n.i.o (nicht in Ordnung/not correct) units

Operators of pressing machines and workers of 100% control are ordered to separate units if there were found minimally 10 n. i. o. pieces of unit with the specific type of fault (burr, crack...). These pieces are separated with description (the number of unit, the amount of units), marked fault on the surface and placed nearby pressing machine (in red box) that produces this unit. On the workplace of 100% control, it is placed in the container which is given for this order. It is important to take a photo of the unit, the date code and the fault and it has to be admitted to defined cell – Fig. 5. If the unit, addressed to photo documentation of the fault, is not placed on pre-defined place, it is needed to closely specific defined fault. For example, the dialog with the operator who made the mistake or controlled it on the workplace of 100% control and report it to the cell could be useful. Examples of faults from photo documentation:



Fig. 5. Cover (crack)



Fig. 6. Lane support (deformation)



Fig. 7. Head (failure operation/unreadable DK)

#### 6<sup>th</sup> step: Filling up the Quality report + Internal complaint

Quality report is reported for units/faults that are on Table of internal quality. If the fault is produced just on certain date code and it is not presented during the following production of the same unit, it is not needed to report the Quality report anymore. On the right side of table 4, there will be written – causality removed. If it be to the contrary, it is necessary to report the Quality Alert and distribute it (in printed or electronic form) to the all workstation. The link is inserted to the folder with Quality report. Internal complaint is reported to the crack faults. In this case, both the Quality report and Internal complaint are reported. This is kept in database of complaints and after fixing of faults, the effectivity is certified. If the unit works well, it is possible to close this complaint.

### **3. RESULTS**

The result of internal quality process is the Quality Alert where are reported information about customer, description of produced unit, description of fault with photo documentation and the sign of drawer with the date of drawing. The drawer is in charge of operators interacting with the unit training what also important aspect for zero faultiness is.



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Quality Alert			
Customer	7898-85765-5485	Part name	Bed
Part no.	12345-3333	Issue	-
Concern no.	Internal notice	Special characteristics	-
Receipt date	29.3.2015		
Concern name:	Crack		
Failure effect at customer	Mismatch of customer request		
Bemerkung Pozn. : Comments	Pieces found by 100% control in HPT. Pressing machine - MW 800 t Date of producing. - 28.3.2015 Date code - 09BE Amount n.i.O - 6ks.		
Defect description			
			
Distribution list	QS, QM, VS, FE, FEL, WB, WBL	Control instruction for DATE	production+ 100% inspection
Created by	Bc. Marek Halenár /QA		29.3.2015

Fig. 8. Quality Alert

#### 4. CONCLUSION

For Huhn PressTech Ltd., experience is the most important assumption to develop the new products, owning to the company clears up whether and how it can be possible to manufacture new metal components. Ultimately, experience is the decisive factor for the rapid, cost-effective and process-able development. Innovative technologies are the guarantee for effective performance in development. Computer aided simulation (AutoForm System) helps to hasten the prototype phase, decrease the cost on prototype construction and generally ensures the stability of the production process. Constantly growing demand on chipless technologies replaces older chip technology. Transfer presses use pressing force from 250 to 800 tons, desks up to 4000 mm. In the machine pool of the company, there is also a modern 630 tons weighted servo press. From the

roll, the company manufactures sheet metal from 0.6 mm to 5 mm, both steel and aluminum. Already mentioned philosophy of zero faultiness achieves absolute accuracy in all areas. Skill and care of workers are also important as a modern machine pool supported by CAD and CAM technology.

This paper aimed to clarify how the company performs fault evaluation and what it does for its correction. In detail, there is explained the procedure of evaluation of internal quality and demonstrated the solution on artificially manufactured units 3333 and 5555. The result is called the Quality Alert.

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