ARCHIWUM INŻYNIERII PRODUKCJI
PRODUCTION ENGINEERING ARCHIVES

2015, Vol. 6, No 1, pp 49-51
ISSN 2353-5156 (print version)
ISSN 2353-7779 (online version)

Article history: Received: 18.02.2015 Accepted: 02.03.2015 Online: 31.03.2015

Available online on: http://www.qpij.pl **Exist since 4th quarter 2013**

Reliability evaluation in the production process of aluminum castings

Erika Jankajová[1], Martin Kotus[2]

[1]Department of Quality and Engineering Technologies, Faculty of Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, Slovak republic, e-mail: jankajova@informslovakia.sk
[2]Department of Quality and Engineering Technologies, Faculty of Engineering, Slovak University of Agriculture, Tr. A. Hlinku 2, 949 76 Nitra, Slovak republic, +421 37 6415689, e-mail: martin.kotus@uniag.sk

Abstract: This article deals with reliability evaluation of the production process for die casting. Reliability of the production process was assessed on the basis of productivity and deformity. With suitably chosen production technology the increasing of labour productivity can be achieved alongside the required quality of aluminum castings.

Key word: production process, die casting, aluminium castings

1. Introduction

Currently, each manufacturing organization resists constraints and threats within its competitors. The key factor for cheaper, superior, and more productive manufacturing is knowledge transfer from the field of science and technical progress (TOLNAI R. 2002).

Numbers of cast parts within a work shift as well as number of cast parts which meet quality requirements represent the decisive influence on economic efficiency of die casting. Therefore, internal spoilages are also evaluated by number of parts from manufacturing batches that do not comply with quality requirements so, they are useless (PETRÍK M., KOTUS M. 2009).

The quality of casts is affected not only by the design solution but also the reliability of permanent moulds. The lifetime of mould depends on the influence of temperature factors for die casting. An important prerequisite for quality cast production is keeping an optimum temperature of each surface part of the mould cavity (MATISKOVÁ D. 2012; MATISKOVÁ D., GAŠPAR Š., MURA L. 2013)

The study aims at a reliable evaluation of the manufacturing process on the basis of assessment of aluminium cast parts manufactured by die casting. Manufacturing process quality is evaluated through monitoring and analysing productivity and spoilages of particular cast parts.

2. Materials and methods

The manufacturing process is evaluated in the organization MOPS PRESS, Ltd. in Snina. The organization specializes in the production and sale of the cast aluminium alloy parts manufactured by die casting with sealing strength 250-750 kN. The organization is

oriented on the production for automobile and electrical industry.

The cast part identified as Lagerschild AS (Fig. 1) and used as an electrometer panel for automatic washing machine BOSCH & SIEMENS is evaluated.

Fig. 1 Cast Lagerschild AS

Workstation L20-630.05 (Fig. 2) consists of a die casting machine CLH 630.05, treatment equipment, and die casting furnace, which is also a batcher and robot for removing and transportation to finishing operation. The casting cycle begins with closing the machine that is activated automatically from the control box. Batching furnace transports the amount of molten metal into sprue. Pressing and solidification are activated by signal from the control box. The machine is opened after the cast solidification time. A Robot takes the cast part out of the form and controls it by visual control equipment, then the robot cools it and transports it to the final operation (shearing). Treatment equipment treats immovable and movable parts of the form and the whole process is repeated. On this workstation the cast parts are also sheared, the robot transports the cast parts into shear press by its arm and then an operator accomplishes shear cut.

Fig. 2 Production machine for Workstation L20-630.05

The number of cast parts is determined by the dispatch note card that is allocated to each manufacturing batch during work shift.

3. Results and discussions

The measured time of the cast part manufacturing cycle consists of partial time for particular operations that are unavoidable for part production. Time is observed for 10 cycles during the morning, afternoon and night shifts and for one workweek (5 work days, 15 shifts).

Measured and calculated values for the number of cast parts, productivity, and nonconformities are the averages (item, percent) for the period under consideration.

Table 1 Cast Lagerschild AS

Work shift	Mon	Tues	Wend	Thru	Fri
Number of cast parts					
morning	1900	1420	2080	2100	2000
afternoon	2104	2000	1860	1900	2080
night	1440	1360	1760	1700	1900
Sum	**5444**	**4780**	**5700**	**5700**	**5980**
Productivity					
morning	98.68	98.38	94.57	96.76	94.30
afternoon	95.39	98.35	96.02	94.16	94.18
night	94.14	94.41	96.08	94.00	94.26
Sum	**96.07**	**97.05**	**95.56**	**94.97**	**94.25**
Nonconformities					
morning	1.32	1.62	5.43	3.24	5.70
afternoon	4.61	1.65	3.98	5.84	5.82
night	5.83	5.59	3.92	6.00	5.74
Sum	**3.93**	**2.95**	**4.44**	**5.03**	**5.75**

The average number of the cast parts produced during one week period, within one work shift is 1,840 pieces. In terms of shift duration, most cast parts are produced within the afternoon shift (1,989 pieces). 1,900 pieces of the cast parts are produced within the morning shift. The least number of cast parts is produced within the night shift (1,632 pieces). In terms of week days, most cast parts are produced on Friday (5,980 pieces), then on Thursday and on Wednesday (5,700 pieces). The least number of cast parts is noted on Tuesday(4,780 pieces).

The average productivity evaluation (Fig. 4) in week days is noted as predictable by the number of the cast parts that meet the specified qualitative customer requirements. The highest productivity is noted on Tuesday (97.05 %), whereas it is 94.14 % on Monday. The number of produced cast parts meeting criteria has a decreasing trend within all rest work days. Productivity reaches 95.56 % on Wednesday, 94.97% on Thursday and the lowest production is 94.25 % on Friday.

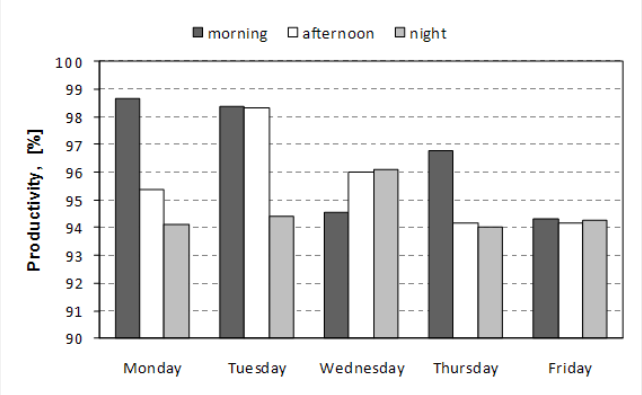

Fig. 3 Productivity of the cast parts manufacturing process on the workstation

The nonconformities evaluation (Fig. 4) in terms of the work shift is highest within the night shift (5.42 %), when the lowest number of produced cast parts is also noted. Most cast parts are produced within the afternoon shift with nonconformities 4.38 %. The lowest nonconformities are accomplished within the morning shift (3.46 %).

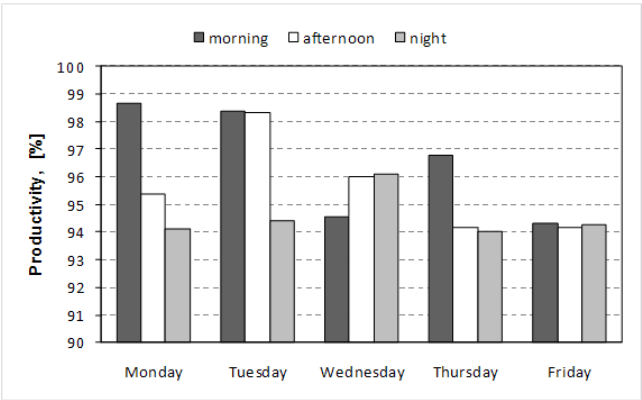

Fig. 4 Nonconformities of the cast parts manufactured on the workstation

On week days, the lowest nonconformities are on Tuesday (2.95 %), when the lowest number of the cast parts is also noted. The highest nonconformities are noted on Friday (5.75 %). Considering Tuesday production, it increases about 2.8 % and the number of produced cast parts also increases about 1,200 pieces.

4. Conclusions

During the whole week, 27,604 pieces of cast parts are produced, productivity reaches 95.58 % and nonconformities are 4.42 %. It is achieved by automated workstation for die cast production with operator interference at a minimum.

The lowest number of cast parts is produced within the night shift, but also the highest nonconformities are reached. The least nonconformities are noted within the morning shift that is affected not only by objective causes, but also by subjective causes of employees, quality manager or employer.

The automated manufacturing process is classified as suitable and effective for the workstation. Productivity of die casting can be improved by keeping the manufacturing methods along with the nonconformities decrement.

Literature

1. KOTUS M., KOVÁČ I., PETRÍK M., KOVÁČ J. Production of aluminium casts through casting under pressure. (Výroba hliníkových odliatkov pomocou tlakového liatia). In Quality and Reliability of Technical Systems. Nitra : SUA, 2009. p.176-180. ISBN 978-80-552-0222-8.
2. MATISKOVÁ D., GAŠPAR Š., MURA L. Thermal Factors of Die Casting and Their Impact on the Service Life of Moulds and the Quality of Castings. In Acta Polytechnica Hungarica, Vol.10, No.3, 2013. p.65-78. ISSN 1785-8860.
3. MATISKOVÁ D. The Methodology of Economics Costs Influential on Automation of Component Production. In American Journal of Economics. No. 7, 2012. p.164-170. ISSN 2166-496X.
4. PETRÍK M., KOTUS M. Automation of casting under pressure in the production process. (Automatizácia tlakového liatia vo výrobnom procese). In Safety – Quality – Reliability. Košice : TU, 2009. p.173-177. ISBN 978-80-553-0137-2.
5. TOLNAI R. Engineering Technology. (Strojárska technológia). Nitra : SUA, 2007. p.319. ISBN 978-80-8069-842-3.