

CHAPTER 1

INTRODUCTION



1.1 Background

In every manufacturing organization, quality of the products is one of the most famous parameters to satisfy the customer requirements. Especially at the present, the competition between motorcycle-part manufacturers is getting higher, consequently satisfaction to customer requirements in good quality of product must be considered. Moreover defects of product, lower quality than customer specification, make the company spend higher production cost of wastes.

Presently, nonconformity of product that has frequently been found, is that the products can not have the specification that customer need. Hence, the company should pay a lot of attention in improving and maintaining the quality of the product.

The company that has been selected for the study is RAKS manufacturing company which its factory is located in Bang Pa Kong Industrial Estate 2. This company is concerned with the motorcycle-part manufacturing and the main customers are well-known brand of motorcycle sellers such as Yamaha, Suzuki and so on.

In this company, the main problems that are having now, are high rates of rejections and the increasing of defects in the production, compared with the previous year, and lower specification of product than customer need but they can accept them, as a mention of quality control department. The problem picked up to study is that the lower specification of products which it has occurred in oil pump shaft production.

The processes of producing the oil pump shafts shown in Figure 1.1 below are:

1. Raw material, steel bar S45C (JIS G 4051 as a Japanese Industrial Standard) that has diameter 13.2 ± 0.15 mm. and 2.50 ± 0.05 m. length, is cut into 73 mm. length (Sawing process)
2. Then it is faced and centered to 72 ± 0.15 mm. length (Facing & Centering process)
3. Then it is chamfered by auto lathe at 15 ± 0.3 degree of the angle of chamfer (Chamfering process)

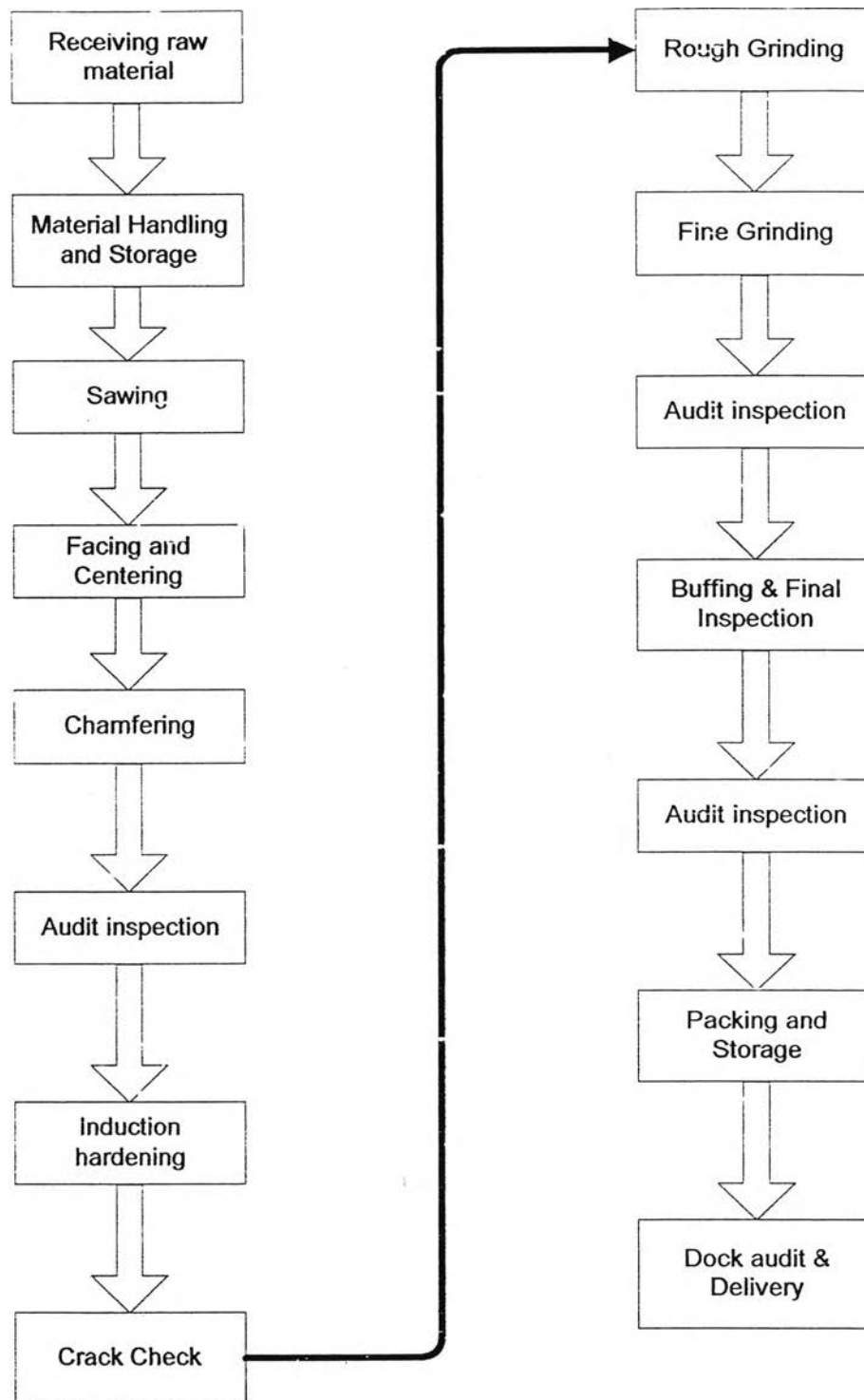


Figure 1.1 The diagram of oil-pump shafts process

4. Next, it is hardened by induction hardening machine in order to has 55-60 HRC of surface hardness and 450 HV of hardening depth at 0.8–1.2 mm. (Induction hardening process)

5. The next processes are rough grinding and fine grinding process for grinding it into 13 mm. of diameter.

1.2 Statement of problem

The problem in oil pump shafts production was that almost all of the oil pump shafts manufactured at present have lower hardness in depth than customer expectation. The trend of the hardness of oil pump shaft being produced is also declining, from information of quality control department, which they are shown in the Figure 1.2 below. From the processes above, the problem of the low hardening depth exactly occurred from induction hardening process which its process will be described in the next paragraph.

Present condition of induction hardening process

Existing condition for	Quenching	Tempering
Power regulator	5	1.75
Voltage (volt)	240	120
Amp (amp)	105	35
Down speed (mm/sec.)	1.8	1.7
Regulator down speed	18	17

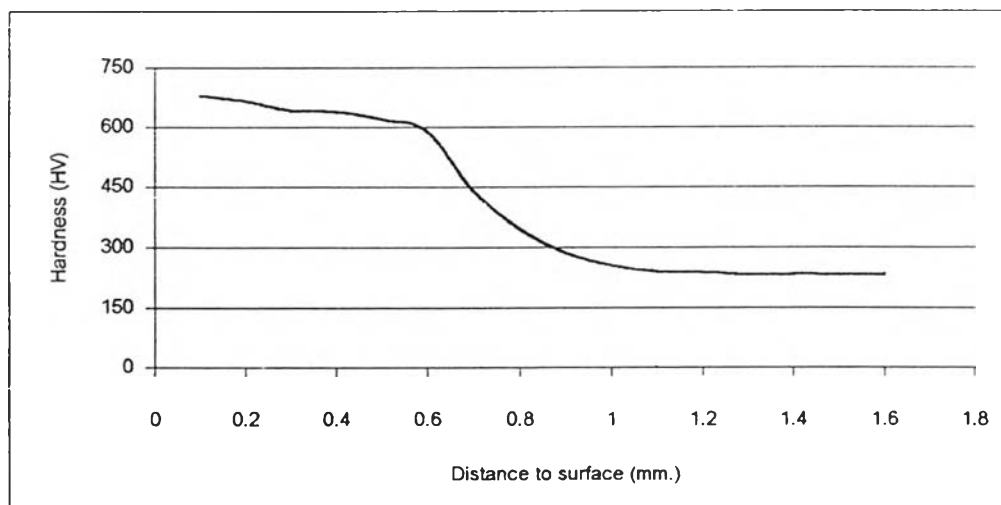


Figure 1.2 Hardness distribution from surface hardening layer to inner core (down speed = 1.8 mm/sec and current = 105 Amp)

In manufacturing oil pump shafts, the induction hardening procedures used in the factory are followings:

- 1) Oil pump shaft that is sew, faced, centered and chamfered into the right size, is taken to grasping stand by operator and locked.
- 2) Turn on the switch to move the oil pump shaft down, pass the coil. At the same time cooling water is spray.
- 3) When it, all, move down pass the coil for quenching process, switch turn off automatically and spray the quenching media immediately.
- 4) Next, the oil pump shaft move up and then down again for tempering process and the quenching media is spray again.
- 5) Then the oil pump shaft move up and stop, and then the operator take it out by hand.

From the pictures above, the hardening depth at 0.8 – 1.2 mm. have lower hardness than customer expectation, which the hardness should be higher than 450 HV. The way in the diagnosis of low hardening depth of oil pump shafts is to diagnosis from the parameters relating in the induction hardening process, for examples, current, temperature and time for quenching and tempering.

In order to provide the good quality of the oil pump shaft, this research will focus on studying the influences that affect the mechanical properties of oil pump shaft, before and after induction hardening process.

1.3 Purpose of research

The main objective of this research was to study the factors of the induction hardening process, that influence on the mechanical properties, which were surface hardness and hardening depth, of oil pump shafts.

1.4 Scope of research

The implementation of this thesis focused on

1. Study only oil pump shaft, which its diameter was 13.2 mm. and its length was 72 mm., produced from steel JIS G 4051, according to Japanese Industrial Standard.

2. This was undertaken to analyze the factors that influence on the mechanical performance of oil pump shaft, in induction hardening process of the case company.
3. Study only the factors, which were electrical current and time affecting to the hardness.
4. Study the changing of mechanical properties of oil pump shaft before and after induction hardening process.

1.5 Expected result

- Understand the factors that influence the hardness and other important mechanical properties of oil pump shaft products in the induction hardening process.
- Understand the mechanical properties of material (JIS G 4051), before and after induction hardening process
- Recommend the suitable conditions of induction hardening process to the factory in order to improve the quality of oil pump shaft to satisfy customer requirement.

1.6 Research procedure

The research procedures were to:

1. Study related theories, researches and literatures
2. Study the procedures of induction hardening process used in the factory
3. Survey the product specifications based on the mechanical properties such as surface hardness, hardening depth hardness, etc.
4. Characterize the raw material (shaft carbon steel) before applying the induction hardening process in order to compare the properties with the standard of JIS G4051.
5. Study the process factors affecting the properties of oil pump shaft such as electrical current, and shaft speed.

6. Test the mechanical properties of hardened product such as hardness, depth hardness and microstructure by Micro Vicker hardness test and microscope
7. Bring the result from the test to conclusion
8. Summarize, and make the recommendations.