

## QUALITY WELDING REPAIR OF DETAILS IN THE PALAJ- KASTRIOT OF KOSOVA POWER CORPORATION (KPC)

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### SUMMARY

*Welding repair is a known method of repairing details that is successfully applied in our country. As a repairing method it is widely used in Palaj – Kastriot that is a separate division of Kosova Power Corporation (KPC). This unit serves for reparation of damaged details in coal mining pits at Bardh i Madh and Mirash. The dominant is repair of shafts of different dimensions, but very often are repaired the other details as well such are: axes, bearing housing gear boxes, tumblers etc.*

*The quality control of repaired details is analyzed in two directions:*

- *Following and comparing the change of mechanical properties and chemical composition before and after welding repair.*
- *Doing the control using Non-destructive testing methods (NDT) that are used a lot in the world, because without destroy the material determine in the very accurate way possible mistakes.*

*In countries with higher economical and industrial development repair details by welding and quality control of them is done with the up to date techniques and developed equipments. This is pretty important because rises the quality of the repaired details at the same time increase their safety that are crucial factors in the entire production process.*

**Keywords:** Welding repair, quality control, repairing details, KPC.

### 1. INTRODUCTION

Welding repair of details is a successful method used in our country. As a method of repair, especially it is used in Palaj – Kastriot factory. This factory is a part of Kosovo Power Corporation (KPC) that serves for the repair of damaged details in working process in open coal mining pits.

Notes taken from Palaj shows that within a year are repaired a large number of details ranging from those with normal size and shape to those with simple giant size and pretty complicated shapes. Details that are frequently repaired belong to the group of machinery shafts, axes, bearing housing, gear housing, etc.

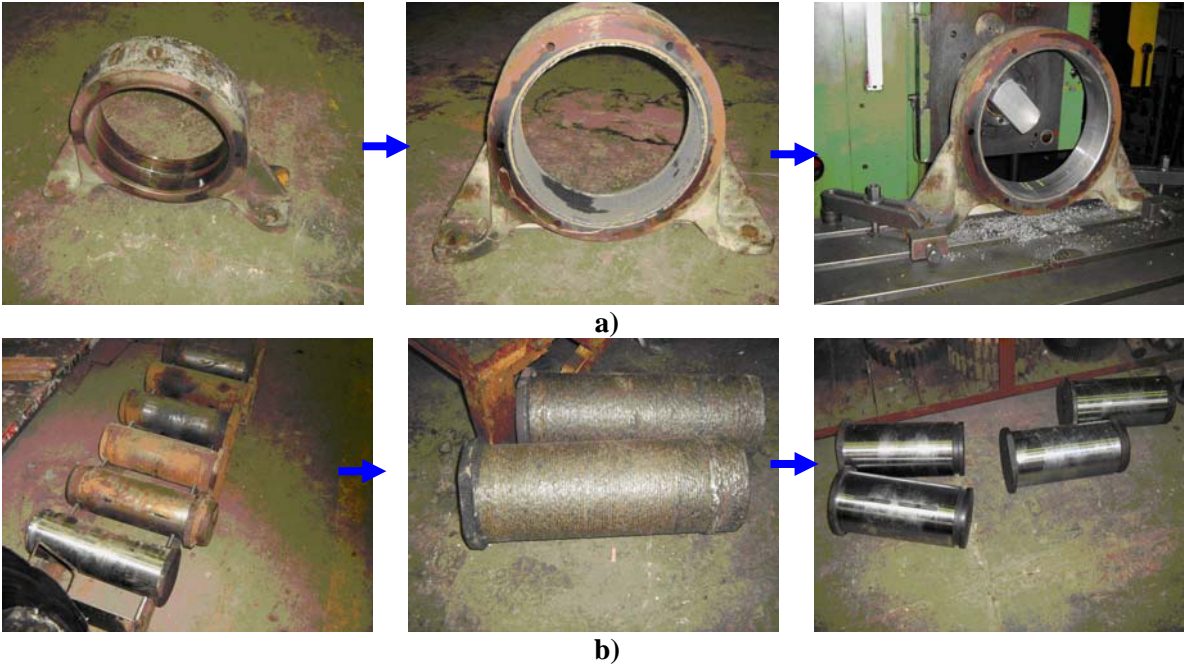
Reparation of damaged details, KPC in one or the other form, is imposed to do, due the inability the corporation has to replace always them with new ones. There are cases that the repair is done successfully also for broken details (usually shafts), even though in normal conditions the same were supposed to be replaced with a new ones. There are other cases that corporation is able to buy the broken details from the region, but this procedure requires time and urgency of production needs details to be returned as fast as they can in the working process. That is another reason why welding repair of different details is used a lot in Palaj.[1]

## 2. DETAILS THAT ARE REPAIRED WITH WELDING AT PALAJ- KASTRIOT

As mentioned at the beginning of this paper, repair of details is everyday work in Palaj. Details that are going to be repaired are different in the size, shape and in their chemical properties. Repair is done according to the nature of damage of detail. Welding repair is used when the details are broken or consumed due to heavy and bad working conditions; excision processing is used for obtaining desirable dimensions required from the technological process, the plastic deformation when the details are so warped etc. But, among the mentioned methods the weld repair and surfacing are the main processes and the most frequently used in Palaj.

It should be emphasized that when detail is broken, first it is rejoined with welding (stick welding is used more in these cases to fill the prepared channel) till the detail reaches the old dimensions. Heat treatment is use for normalization of its inner structure. After this starts process of surfacing of broken detail.

In the following figures are given different details that are going to be repaired with welding.



*Figure 1. Welding repair of consumed details;  
a) Phases of bearing housing repair of the rolling bearing of tumbler to dimensions  $\Phi 800 \times 2100$   
b) Phases of repairing small axes of oscillator*

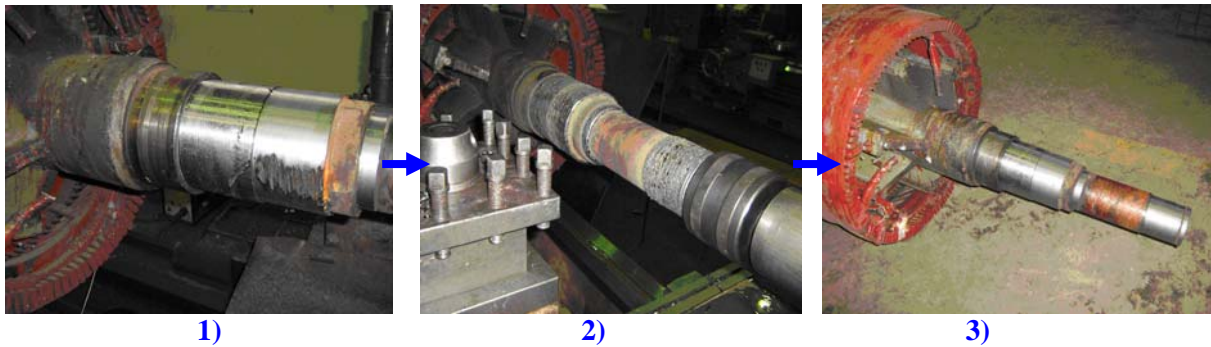


Figure 2. Stages of welding repair of 630 KW shaft, mechanically damaged  
 1) View of damage to the shaft stress, 2) Surfacing (filling) material with the backbone  
 3) View of the backbone ready for processing after the mechanical shearing

### 3. QUALITY CONTROL OF DETAILS AFTER WELDING REPAIR

Welding as a process is pretty complex and multidisciplinary. During its use it is required carefully and accurately the proper technique and right welding parameters to be selected and the welder to be professionally prepared as well. Despite the will that those and the other factors to be chosen in the best way possible, still it is impossible mistakes to not happen. That's why in the repaired details mistakes of different types are shown. This inevitable implies the need of the control of repaired details. Quality control of repaired details is very important and is done to make sure if the repaired detail fulfills the necessary technical conditions to return back in the working process

Control of details after repair includes:

- Visual Control
- Control of mechanical properties
- Control of chemical composition
- NDT methods such are; visual, penetrant liquid, ultrasound, magnetic, etc.

#### 3.1. Hardness measurement of details after welding repair

Welding repair of machinery details besides the purpose to improve the geometrical form and obtain again the desirable fits, it also raises the hardness of them. In Palaj, to measure the hardness of repaired details is used the Unit MIC 10 Krautkramer (figure 2). Before measurement, it is necessary that details to be cleaned. Three or more consecutive measures are done and in the end are found the average value. Image of MIC 10 and the way of measuring the hardness of different details is given in the following figure



Figure 3. Krautkramer MIC 10 Unit for measurement hardness.



Figure 4. Measuring hardness of details after welding repair

The results of hardness measurement of some details done in Palaj, before repair, after repair or after heat treatment if it was necessary, are given in the table below.

Table.1. The results of hardness measurement of some details

	Type off details	Material	Hardness		
			Before repair	After repair	After heat treatment
1	Axcis dentiform conical-helical $\Phi$ 247 x 1097 mm redactor to bar I and II to redactor SRs 400	<b>42CrMoS4</b>	22 HRc	25 HRc	30 HRc
2	Bearing housing of tumbler action $\Phi$ 800 x 2100 mm	<b>42CrMo4</b>	19 HRc	22 HRc	
3	Axcis of the insurance links working wheels $\Phi$ 215x1560 mm to redactor SRs 315	<b>Ck60</b>	23 HRc	28 HRc	38 HRc
4	Axciss off Electromotors 315 KW	<b>Ck45</b>	18 HRc	23 HRc	

#### 4. QUALITY CONTROL OF WELDING REPAIRED DETAILS USING NON-DESTRUCTIVE METHODS IN PALAJ

In this group are involved all the methods used to study the quality of repaired details by welding without destruction of basic material. With these methods is possible to explore the surface and internal errors. With these methods is also possible to identify;[6]

- Internal mistakes such as porosity, cracks, scum etc. These mistakes affects in the homogeneity of bearing housing
- Discontinuous of seam
- Structural change of chemical composition or mechanical properties

Each method has several variants of use, which differ from each other. Each method has advantages and disadvantages for its use. They can be used for different sizes and shapes and different surfaces and thicknesses.[2, 3]

In NDT methods belong:

- Penetrant liquid method
- Ultrasound Methods
- Magnetic method
- Radiation Method ( "X"-rays and gamma-rays)[4]





Figure 5. Ultrasound KRAUTKRAMER USN 52 L used by the Institute "INKOS" and ways of controlling the details with it

#### 4.1. Control of bearing housing of tumbler

Stages of control of bearing housing will be presented as following:

1. Visual control and detection of potential errors and cracking around.
2. Cleaning surfaces with a cotton cloth cleaner
3. Liquid penetrant is thrown on the space that is controlled. Penetrant type is SKL - SP1 Penetrant Spotcheck red color.
4. After 15 minutes the controlled space is cleaned with water and cleaned with special cleaner and drain 30 PM Cleaner with paper cloth.
5. After cleaning a white developer PM 24 is thrown to the detail.. Developer is kept in the distance of 15-20 mm from the surface of the detail
6. Expected to appear on the surface points within the red that shows the presence of surface cracking and other possible mistakes of the repaired detail.
7. Ultrasound check. It is used ultrasound KRAUTKRAMER USN 52 L an expensive device and very effective. Device has ability assign defects of detail, even up to 5 m depth.[4]



Figure 6. Stages of control of bearing housing will be presented

## 5. COMPILATION OF TECHNOLOGICAL PROCESS FOR WELD REPAIRED DETAILS AND THEIR CONTROL

Compilation of a technological process of repaired details by welding is a process that includes all the necessary elements. It includes all parameters and factors necessary to understand why the detail is brought for repair, analysis of repair process and steps that are

included in the quality control of the detail after its repair with welding. Technological process can be short or long that depends from details configuration and the level of damage.[4,5,6]

## 6. CONCLUSION

Welding repair of details uses different methods of welding, but in Palaj dominant is electric arc welding methods such as GMAW and MAG method. Economic factor is decisive in the selection and use of these methods.

As the welding process is pretty complex and multidisciplinary, in careful way should be chosen welding technique, welding parameters and welder himself should be qualified and be familiar with all these factors. Despite the good will, these and other factors are not always fulfilled in a sufficient level during the repair. This raises inevitably the need of quality control of repaired details. Quality control of repaired details is very important and should be done always after repair.

This paper is a symbolic contribution in the understanding of the importance that control of the details after their repair has in increasing of production and in increasing its safety. In this study the control of repaired details is analyzed in two directions;

- Following and comparing the changes of mechanical and chemical composition before and after repair and
- Control using NDT methods that are used a lot today in the world.

Results taken from the experimental work have shown that in Palaj thanks to the good staff, repairing of details is performed successfully even though the equipments and machinery used are a bit old.

NDT methods are relatively new methods for control in our country. But, fortunately they started to be used in the proper way and efficiently which will have impact in the quality of work of machines and increasing the safety in general.

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