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Theoretical and Experimental Research on the Reliability of Parts Rehabilitated by Arc Welding

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The paper presents a technical-experimental study encountered in the repairs of the rotor blades to Kaplan turbines due to cavitation wear due to the cyclical stresses of the surfaces in contact. The repair of the Kaplan turbine rotor pallet was performed for the purpose of metal deposits to compensate for wear, to recover parts with cracks, cracks or bursts in the base material in order to reduce major costs associated with the operation and maintenance of the installations and equipment that make part of the production process.

Keywords*: reliability, rehabilitation, welding load, rotor blades.*

1. Introduction.

Qualitative rehabilitation of parts is assessed by aggregating several features that give the rehabilitated piece the ability to meet the requirements for normal operation.

Because one of the key properties that a remanufactured piece has to have is a fail-safe time that must be at least 70-80% of the lifetime of a new piece, the level of reliability depends on the quality constructive solutions adopted.[1]

Thus, in the case of gauge and turbine rotor blades it is imperative that the repair be carried out in a relatively short time, with the reduction of the expenses related to the operation and maintenance of the installations and equipment involved in the production process.[2]

One of the main directions with regard to the importance of the reliability of remanufactured rotor blades is the carrying out of the theoretical and experimental research in the exploitation phase by establishing the admissible dimensions up to the corrective maintenance interventions.[3]

2. Stages of establishing the level of reliability.

At the Kaplan turbine blade operation stage at CHE Cerbureni, the reliability of the remanufactured parts was evaluated based on the performance data of the product.

Due to the cavitations wear on the surface of the rotor blades, intrados and extrados, the reliability changes over time and is maintained at a certain level through corrective and preventive maintenance interventions.[4], [5], [6].

Among the methods used can be mentioned:

- Restoration of defective repair dimensions;
- Return to initial dimensions of the rotor blades;
- Replacement of the used part with specific mechanical methods;
- Refurbishment by electric welding;[7], [8].
- The technical quality control of the reconditioned parts by non-destructive methods.

The edges of the deformed surfaces, cracks and cracks with the size of the processed craters were prepared, as shown in FIG. 1 for blades 3 and 6, intrados and extra. Because the technology is similar, only the rotor blade 3 is presented in the paper.

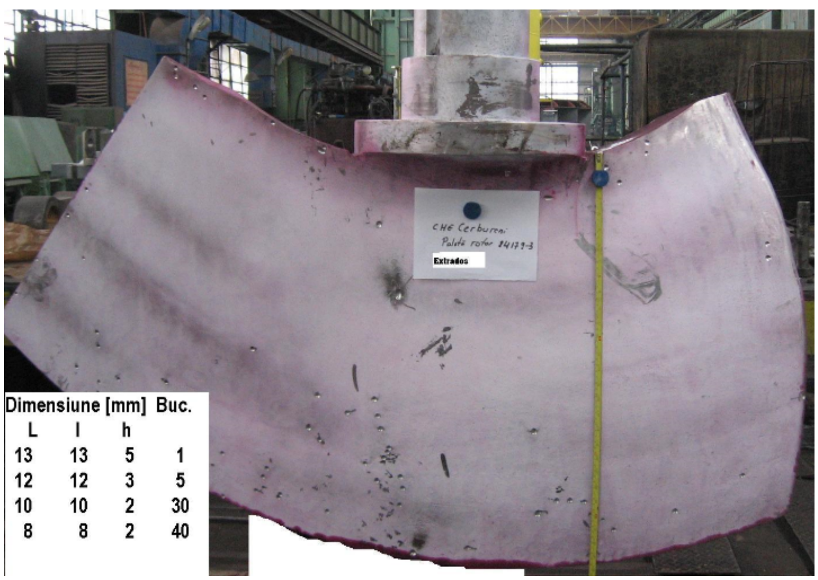

Figure 1. Rotor 3 Extrados palette

The applied welding technology can include:

Base material type T8NiCuMnCr130, ER410NiMo addition material, WTA GTAW manual, Size of Filler Metals: Ø1,2; Shielding Gas; Thickness Range: Groove; Welding of Groove: PA; Preheat Temp. Minimum: 120^{0}C.

According to the welding procedure specification, the parameters of the welding mode are:[9]

Current DC-; Amps (Range): 100-180A, Volts Range: 14-18V.

Figure 2. Rotor 3 Intrados Palette

At the ends of cracked or cracked defects, cracks will be executed along the crack for welding, and the ends of the cracks will be delimited by holes of 3 ... 8 mm in diameter, depending on the thickness of the piece, to prevent further cracking. The shape of the resulting cavities resulting from the polarization is shown in Figure 3.

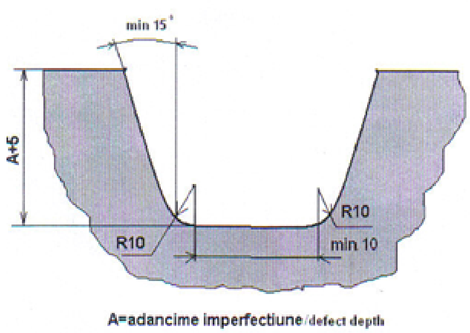

Figure 3. Form of cavities resulting from polishing

In order to avoid dilution with the base material, the surface was plated. For this purpose, two coats have been deposited with high strength material to avoid damage during reconditioning technology. The plating curve and the layered coat order are shown in Figure 4.

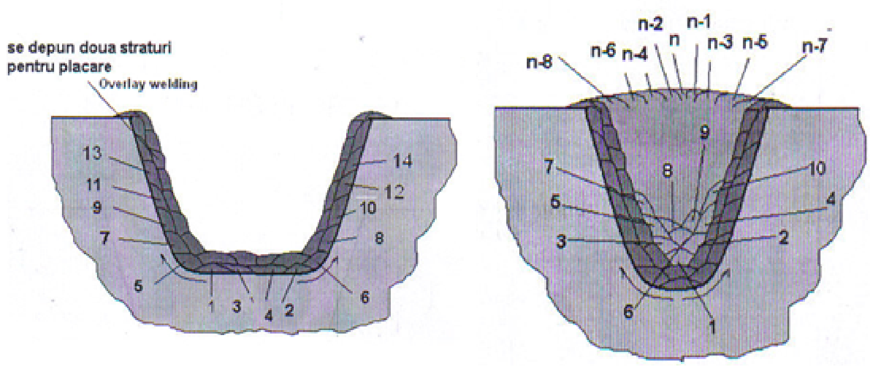

Figure 4. Layout and Layer Layout

In the sketch of the welding procedure sequences of figure 5, the depth of the work cavity A, the upper radius of the cavity R4, and the cavity processing angle of 100 can be seen.[10]

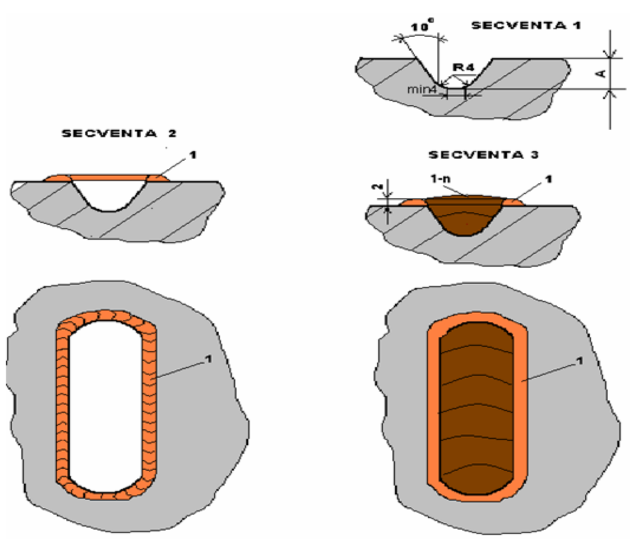

Figure 5. Drawing of the electrical welding procedure

After welding the rehabilitated piece, it undergoes a thermal treatment to improve the 580^0C, holding time: 8h, to prevent the formation of fragile structures after welding.[11]

4. Conclusion

The advantages of this rotor blade refurbishing process are manifold. Starting from the fact that the refurbishment is done with simple, cost-effective devices and then, considering the fact that the layers deposited by welding can vary in thickness, this technology is preferred.

Preparatory operations of defective surfaces are not complicated, often reducing to simple scrubbing or degreasing.

Welding technology processes are productive efficient and cost-effective, mechanized or automated, which means that parts that include a great deal of workmanship and material can be rehabilitated.

After rehabilitation, the track has a durability similar to that of new tracks.

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