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MAINTENANCE AND TECHNOLOGIES OF RECONDITIONING OF SOME PARTS FROM THE CONSTITUENTS OF THE COGENERATION GROUPS

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Abstract: CHP groups play an increasingly important place in the simultaneous production of electricity and heat. Their operation at the design parameters, is a constant concern of specialists, knowing that they still offer enough availabilities that can be pointed out. At the same time, to ensure a good quality operation, and ever longer periods of service in parallel with operation at full capacity, it is necessary to ensure a strict maintenance and repair. Within the awarded space and at an approachable level, in the work are presented the most important data regarding the maintenance and reconditioning technologies of some parts from the constituents of cogeneration groups for the simultaneous production of electricity and thermal energy.

***Key words*:** maintenance, reconditioning, cogeneration groups.
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1. INTRODUCTION

The cogeneration groups can be for domestic use as well as industrial use, operated with fuel as; natural gas, coal, Diesel fuel and biogas.

According to SR EN 13306, maintenance is defined as being the assembly of technical, administrative and management activities developed during the life of a useful product, in order to maintain or reestablish the state in which it performed the known tasks.

The periodical adjustment, emergency repairs, repair works, rehabilitation or improvement operations represents the specific activities of the maintenance.

Maintenance, as a whole, includes activities of supervision, control, inspections, emergency repairs, maintenance, repair, renewal, all ensuring the preservation of the working potential of the equipment, continuity of functioning and the quality of the service performed [1].

2. COGENERATION GROUPS USED

Cogeneration is simultaneous production of electricity and heat, using fossil or renewable fuel.

In Figure 1 is presented the basic diagram of o cogeneration group, made up by an internal combustion engine and a heat recovering unit.

The cogenerating group spares energy as a consequence of producing simultaneously electricity and heat, thus preventing the major losses from the power stations.

According to the basic diagram from Figure 1, the heat obtained during the operation of the thermal engine, is given up to the primary agent of the thermal station, through the heat exchangers, achieving thus the thermal energy. On the engine shaft, reaching certain speed, a generator is connected which produces the electricity delivered to the consumers.

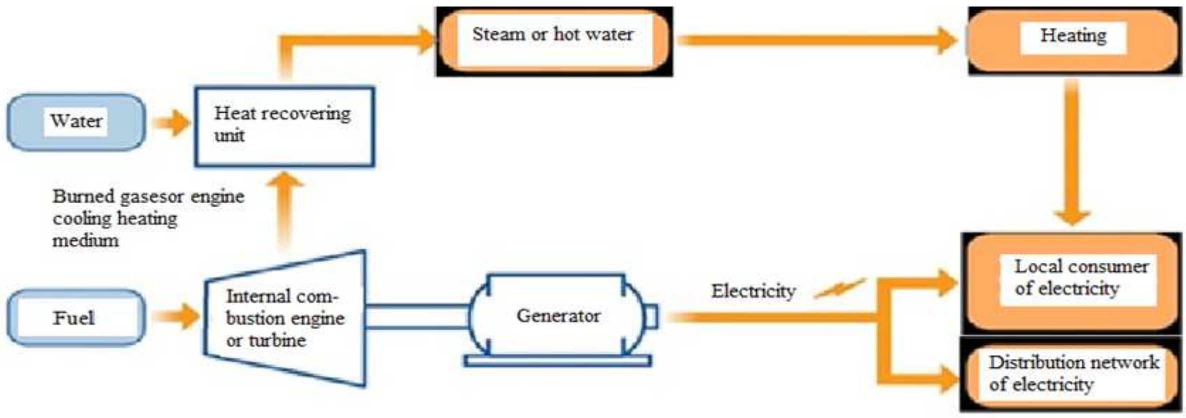

Fig. 1 The basic diagram of a cogeneration group

The cogeneration installations are dimensioned in relation to the heat energy requirement, the electricity being a “secondary” product.

The small cogeneration groups are used mainly for pensions, hotels, or owners associations.

Fig. 2. Medium size Cogeneration Group

3. DEFECTS OF THE COGENERTION GROUPS

Determining the correct wear and allowable clearance of different parts or joints, has a special importance from the technical – economical point of view, because:

Formerly reformation of the parts leads to the increase of spare parts consumption and of production costs;

The use of parts over the allowed limit of wear leads to increase of energy consumption, not observance of the technical conditions, removing the possibilities of reconditioning, at the appearance of the defects and even to accidents in the production process.

The allowed limits of wear at the cogeneration groups is appreciated based on the following criteria: the technical criteria, technological of functional criteria, the economic criteria, possibility of reconditioning and the safety functioning criteria.

In Figure 3 are presented the curve of variation of wear for the parts of a joint, from where results [2]:

$$J_{max}=J_i+U_{1max}+U_{2max} \quad (1)$$

Where: J_{max} the limit clearance of the joint;
J_i – the initial clearance of the joint;
U_{1max} – the allowed wear of the shaft;
U_{2max} – the allowed wear of the bore.

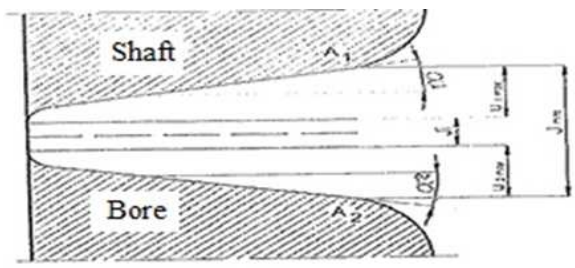

Fig. 3. Variation of wear for the two parts of a joint

In the inflexion points A_1 respectively A_2, appears a limit wear. This situation is met at the bearing and crankpin of the crankshafts of the cogeneration engines, at the connection of the bolt – piston, where we have enhanced dynamic stresses.

The shock mechanical work at a connecting rod – crank mechanism can be computed with the formula [2]:

$$L = \frac{m*(v_1-v_2)^2}{2}, \quad (2)$$

where: m is the reduced mass of the cogeneration group;

v_1 – maximum speed of the crank, appropriate to the moment of separation of the spindle from the surface of the bore;

v_2 – the speed of connecting rod head in the moment of the shock.

Knowing that [2]:

$$v_1 - v_2 = \frac{3}{4}R * \omega \sqrt[3]{\frac{16*j^2}{R^2}}, \quad (3)$$

From the formula (2) results:

$$L = 1{,}78 * m * R^2 * \omega^2 \sqrt[3]{\frac{j^4}{R^4}}, \quad (4)$$

in which: R is the crank radius;

ω – angle speed of the rotating part;

j – clearance of the joint.

Defects which appear at the cogeneration groups can be classified according the following criteria:

- according to the causes that produced them (design, manufacture, installation, or use);
- according to the service life of the equipment (early, aleatory, aging);
- according to the speed of appearance (sudden, progressive);
- according to the frequency of appearances (seldom, frequent, chronic) etc.

Supervision allows to detect the defects in real time and to solve them in the shortest time possible.

4. MAINTENANCE OF THE COGENEATION GROUPS

In Figure 4 is presented the structure of the basic activities of the maintenance of repairable equipment according to the norm SR EN 13306.

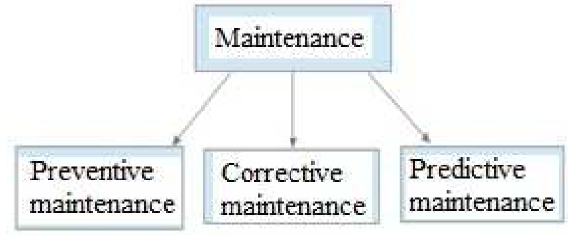

Fig.4. Maintenance types at the reparable equipment [1]

If at the beginning were regarded the maintenance at predetermined intervals of time, at the moment, the maintenance managing informatics systems have broadened the aspects which have to be taken into consideration at the work out of maintenance programs. In this context, are taken into account as determinant:

– the equipment functioning out of the normal parameters;
– premature or unexpected failure;
– the costs of bringing into operation of the equipment.

For greater availability of the machines it is necessary that the time for maintenance is maintained as low as possible. This time is made up from: the time to locate the defect; time for achieving different modifications; time for preparing the intervention; reconditioning the outworn parts; time for making the repairs and performing the tests.

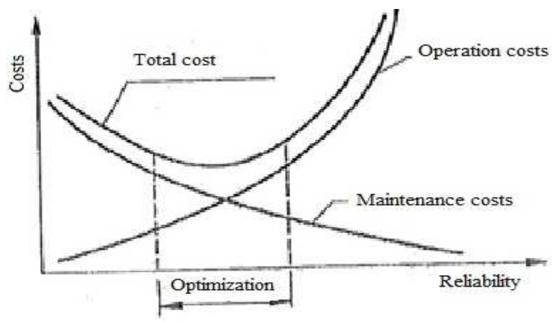

Fig. 5. Variation of the costs depending on the time of operation of an engine [2]

Raising the level of reliability and operational safety through maintenance activities require spending (fig. 5), which stack with the original design and execution expenses and determine a higher total cost [1].

5. RECONDITIONING TECHNOLOGIES

After a certain number of operating hours, for a cogeneration group, some heavy stressed parts present a wear status which makes impossible further operation of the respective group.

Reconditioning through remaking the original dimension is achieved according to the type of the part and of the material from which the part is manufactured, through more procedures: metal coat-ing, facing, electrolytic coating, through soldering, through special methods, etc.

The total cost of reconditioning is indicated not to grow more than 70 – 80% from the price of a new part, of course provided obtaining a quality of the part almost identical to the original part [2].

6. CONCLUSIONS

The maintenance activities are designed to ensure the availability of the object to whom they are applied, include all the interventions and necessary operations to fulfil this scope.

Maintenance of the cogeneration groups is efficient because:

- increases the operating efficiency of the equipment;
- reduces the time of standstill of the cogeneration group;
- increases the duration of use of the cogeneration group;
- diminishes the replacement costs for spare parts.

The maintenance activity must be considered as an investment in the future.

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MENTENANȚA ȘI TEHNOLOGII DE RECONDIȚIONARE A UNOR REPERE DIN COMPONENȚA GRUPURILOR DE COGENERARE

Rezumat: Grupurile de cogenerare dețin un loc tot mai important în producerea simultană a energiei electrice și termice.

Exploatarea lor la parametrii proiectați, constituie o preocupare continuă a specialiștilor, știut fiind faptul că acestea oferă încă suficiente disponibilități ce se pot pune în valoare. În același timp, pentru a se asigura o funcționare de bună calitate, și durate de serviciu tot mai lungi, în paralel cu exploatarea la întreaga capacitate, este necesar să se asigure un regim strict de întreținere și reparare. În limita spațiului acordat și la un nivel accesibil, în lucrare sunt prezentate cele mai importante date privind mentenanța și tehnologiile de recondiționare a unor repere din componența grupurilor de cogenerare pentru producerea simultană a energiei electrice și termice.

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