THE RELIABILITY INDICATORS FOR MINING HYDRAULIC AGGREGATES

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Abstract: *The paper present the research results regarding the reliability of the hydraulic aggregate used in mining exploitations from Jiu Valley area. The Pareto diagrams and reliability indicators have been determined using experimental data.*
Key words: *reliability indicators, Pareto diagrams, packing plunger, high pressure pump.*

1. PARETO DIAGRAMS

Three AH 78/350 hydraulic aggregate were studied in exploitation at the mining exploitations from Jiu Valley area.
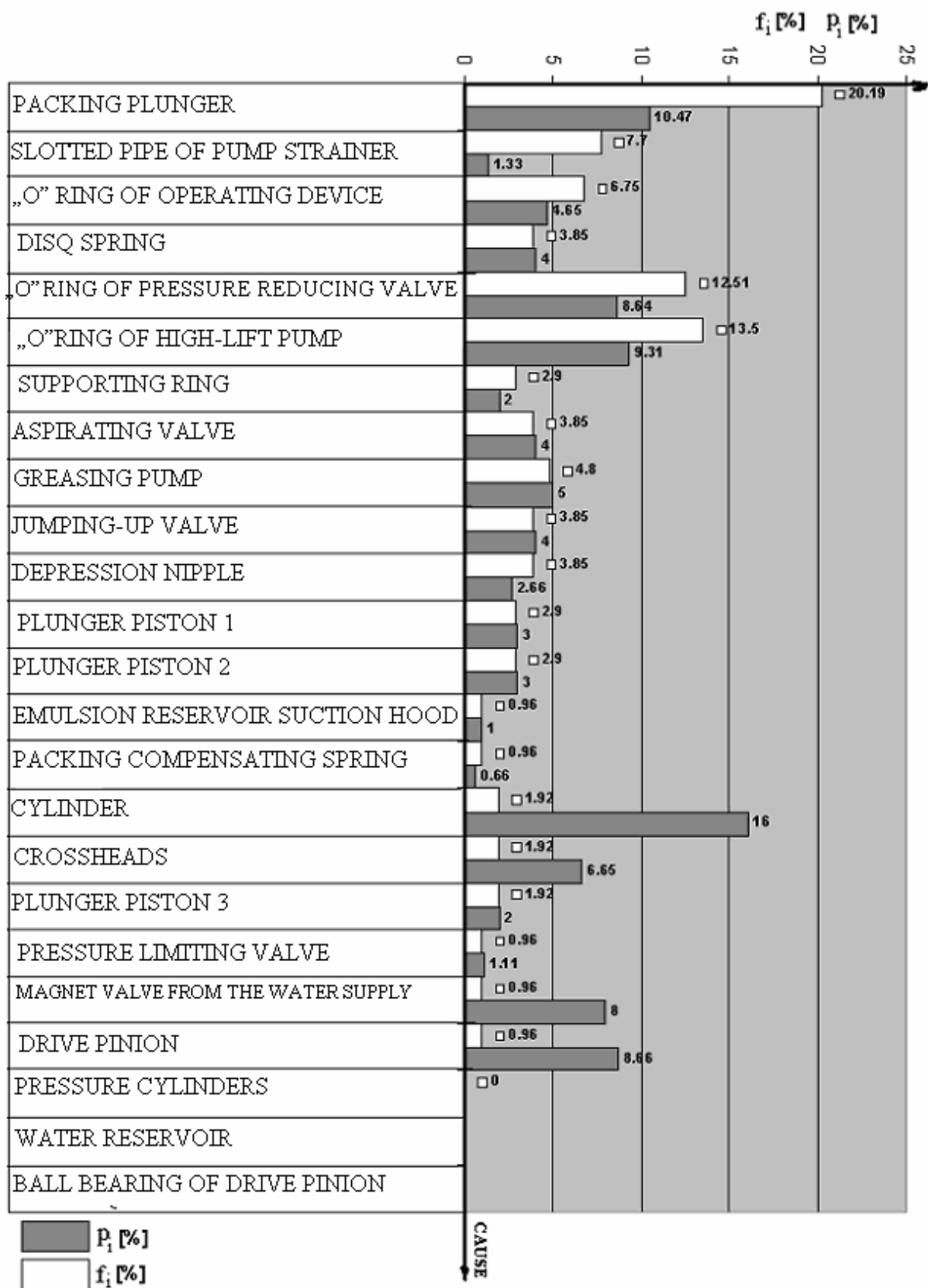
For the hydraulic aggregate represented with symbol A, the falls frequency – cause diagrams are shown in figure no. 1.

It is observe that the biggest values of the falls frequency are found at the packing plunger (20,19%), "O" ring of the high pressure pump (13,50%); "O" ring at the pressure reducing valve (12,51%).

Concerning to the frequency of the recondition period, figure no. 1 also shows that the biggest values are for the repair of: cylinders (16%), although the percent of the falls frequency is only 1,92%; the packing plunger (10,47%); "O" ring of the high pressure pump (9,31%); "O" ring at the pressure reducing valve (8,64%). There are also high percent for the magnet valve repair (8%) and for the crossheads (6,65%) although the falls frequency are relative small.

Figure no. 2 shows the falls frequency and the recondition period for the hydraulic aggregate represented with symbol B. It is observe that high values of the falls frequency can be found at: "O" ring of the high pressure pump (18,10%); "O" ring at the pressure reducing valve (12,93%); packing plunger (12,93%).
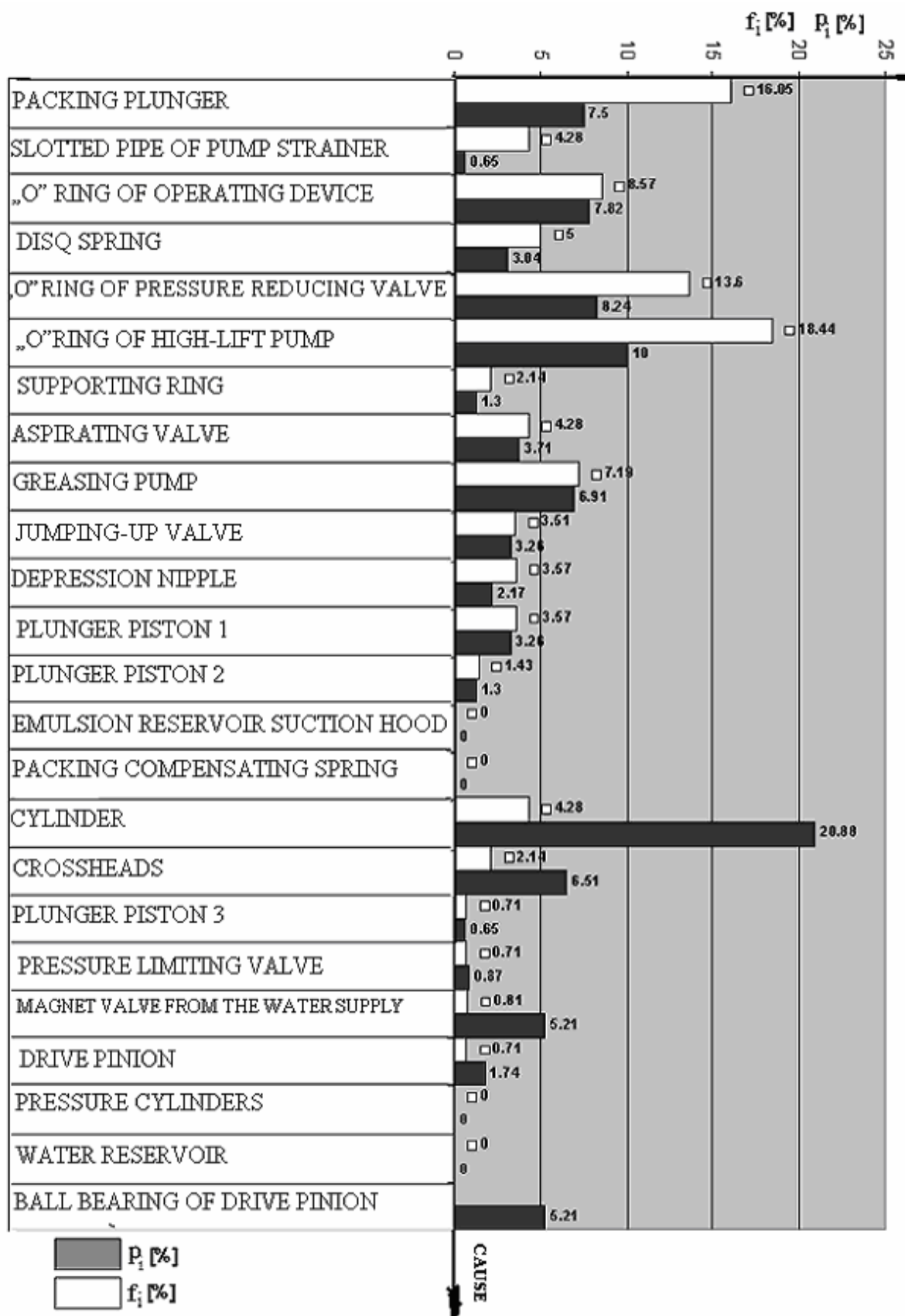
High percents of the recondition period frequency can be found for the repair the following marks: cylinders (19,11%); "O" ring of the high pressure pump (11,15%); "O" ring at the pressure reducing valve (7,97%).

Fig. 1 *Pareto diagram to the falls frequency f_i and the recondition period p_i for the hydraulic aggregate AH-78/350 represented with symbol A*
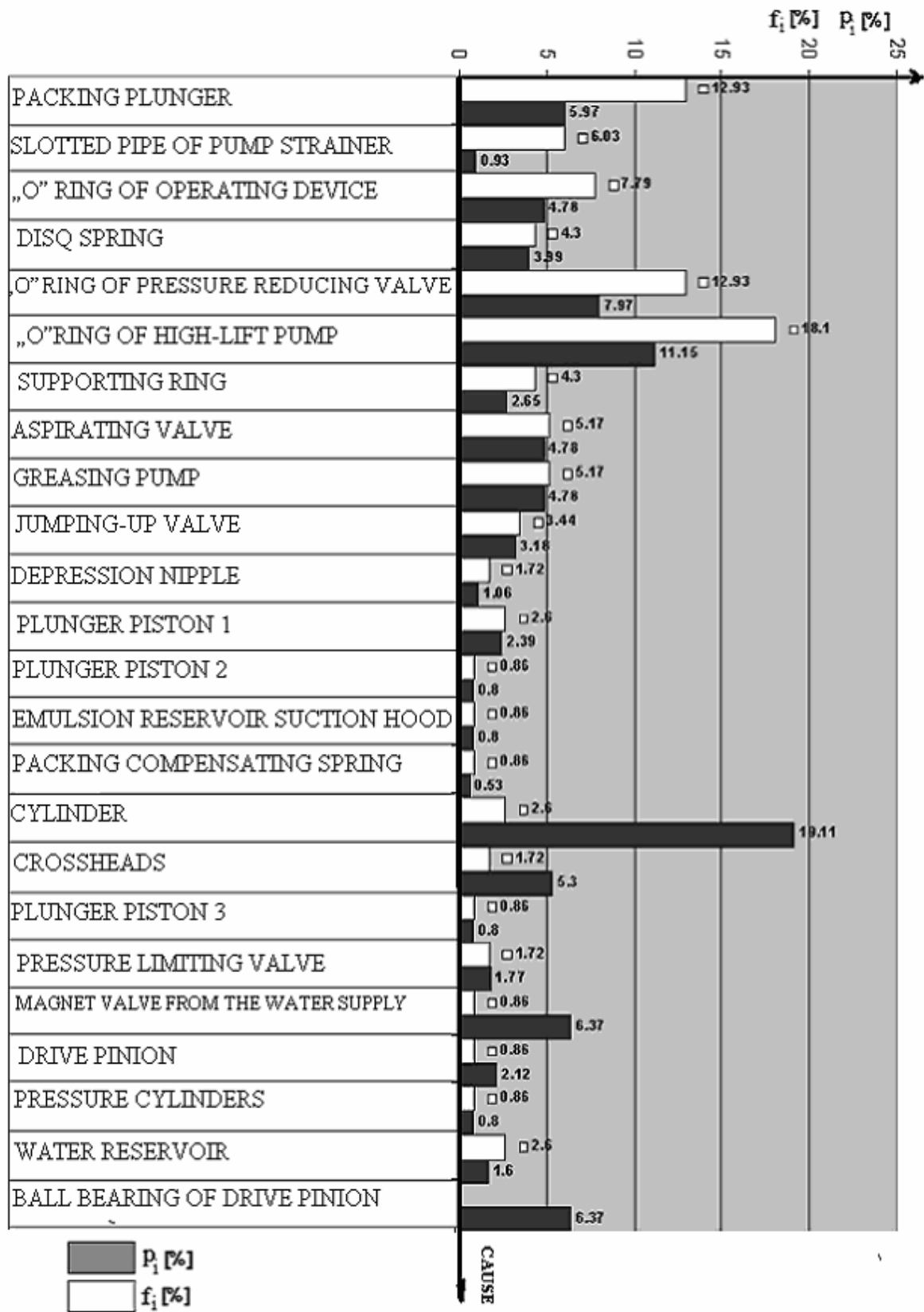
Fig. 2. *Pareto diagram to the falls frequency f_i and the recondition period p_i for the hydraulic aggregate AH-78/350 represented with symbol B*

Fig. 3. *Pareto diagram to the falls frequency f_i and the recondition period p_i for the hydraulic aggregate AH-78/350 represented with symbol C*

For the hydraulic aggregate represented with the symbol C, the falls frequency diagrams and the recondition period frequency are presented in figure no. 3.

It is observe that the biggest percents of the falls frequency is caused by the scored disturbances at: packing plunger (16,05%), "O" ring of the high pressure pump (18,44%); "O" ring at the pressure reducing valve (13,60%).

High percents of the recondition period frequency can be found for the repair the following: cylinders (20,88%); "O" ring of the high pressure pump (10%); "O" ring at the pressure reducing valve (8,24%).

For all of the three hydraulic aggregate types the biggest percents of the falls frequency is caused by the scored disturbances at: packing plunger (16,39%), "O" ring of the high pressure pump (16,11%); "O" ring at the pressure reducing valve (13,10%). Else, it is observe that the same marks have presented the biggest falls frequency for all of the three hydraulic aggregate studied.

Also, we can see that the biggest percents of the recondition period are for repair the following: cylinders (16,9%); "O" ring of the high pressure pump (10,20%); "O" ring at the pressure reducing valve (8,26%) and packing plunger (7,78%). It is observe that these four marks present the highest recondition period for all hydraulic aggregate studied in exploitation.

2. RELIABILITY INDICATORS

Based on data concerning to exploitation response of AH 78/350 hydraulic aggregate have been determined the reliability indicators: the mean time between failures (MTBF), the falls rate (λ), the mean time repair (MTR), the repair rate (μ) and the availability rate (C_D). The obtained values of all these indicators for the marks which have presented enough falls, are shown in table no. 1.

3. CONCLUSIONS REFERRING TO THE RELIABILITY OF THE HYDRAULIC AGGREGATE

The falls frequency and the recondition period histograms allow us to discover the percent with which different marks disturbances from the function or in recondition period of AH 78/350 hydraulic aggregate.

Table no.1. Values of the reliability indicators

Nr	Part name	MTBF (hours)	$\lambda \, 10^{-3}$ (hours^{-1})	MTR (hours)	μ (hours^{-1})	C_D
1	PACKING PLUNGER	487,2	2,02	1,5	0,66	0,997
2	SLOTTED PIPE OF PUMP STRAINER	1440	0,69	0,5	2	0,999
3	„O" RING OF OPERATING DEVICE	1106,4	0,904	2	0,5	0,98
4	DISQ SPRING	1874,4	0,53	3	0,33	0,998
5	„O"RING OF PRESSURE REDUCING VALVE	724,8	1,37	2	0,5	0,997
6	„O"RING OF HIGH-LIFT PUMP	532,8	1,87	2	0,5	0,996
7	SUPPORTING RING	2145,6	0,46	2	0,5	0,999
8	ASPIRATING VALVE	1915,2	0,52	3	0,33	0,998
9	JUMPING-UP VALVE	2040	0,48	3	0,33	0,998
10	GREASING PUMP	1521,6	0,65	3	0,33	0,998
11	DEPRESSION NIPPLE	2174,4	0,46	2	0,5	0,999
12	PLUNGER PISTON 1	2472	0,40	3	0,33	0,999
13	PLUNGER PISTON 2	3732	0,26	3	0,33	0,999
14	CYLINDER	3098,4	0,32	24	0,004	0,992
15	CROSSHEADS	3662	0,27	10	0.1	0,997

It is noticed that for all three hydraulic aggregate taken individual, the marks that have the most falls are the same, with small difference in the percent which they intervene in the total of scored disturbances: the packing plunger; "O" rings of the high pressure pump, the pressure reducing valve and the command contraption, these marks that add the cylinders, present also the biggest repair period.

The reliability indicators from table no. 1 show us that the biggest values of the falls rate, respectively the smallest values of the mean time of function can found at the packing plunger and "O" rings, which have the biggest percents of falls frequency.

Although the upper marks have at the indicator – the mean time repair – the smallest values respectively at repair rate the biggest values, the period frequency of disturbances at these marks is bigger due big number of falls.

Concerning the availability coefficient is noticed that the minimum values can be found for the same four marks for which present also the biggest period of repair times.

4. REFERENCES

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