METERING PUMPS FOR CONSISTENT GREASE DEFECTS STUDY USED AT BUCKET WELL EXCAVATOR E_SR_C 1400

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Abstract: The paper presents the results of analysis performed on different types of metering pumps for consistent grease from equipment of bucket well excavators in operation in various open pits such as E.M. Jilţ, E.M. Rovinari, E.M. Roşiuţa. Study is being conducted for the case of type bucket well excavator E_SR_C 1400. With the modernization of the bucket well excavator it was attempted the lubrication system standardization, so that the maintenance is done correctly and easily. Lubrication system composition has undergone many changes over the operation of the equipment, with positive or negative influence on its functioning.

Keywords: metering pump, local lubricator, electro pump, consistent grease, maintenance.

1. INTRODUCTION

Designing and implementing a suitable lubrication system ensures the functioning in the best conditions of the entire excavator EsRc1400-30/7, while the quality of the hydraulic components of the equipment influences the behavior of its lubrication system.

Metering pumps are designed to equip centralized lubrication systems with consistent grease and have the role to lubricate directly or through progressive feeders the lubrication points.

A metering pump has a number of outputs (discharges) that vary depending on the type of construction. For each output is possible to adjust the grease flow from zero to maximum.

The pumps presented here have the same functional and constructive solution, forming a series with a large number of common parts or parts with the same basic components (cast or forged). They differ in number of outputs and type of operation.

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2. METERING PUMPS FOR CONSISTENT GREASE

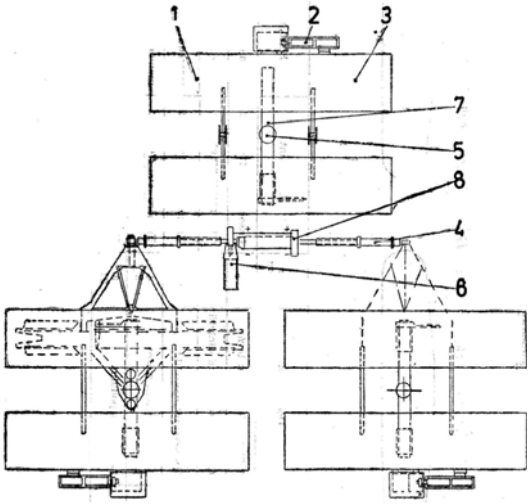

Fig. 1. Crawler travel mechanism

The central grease lubrication system of the excavator EsRc1400-30/7 includes: central lubrication of the crawler travel mechanism (fig. 1) and loading cart, lubrication of the connecting bridge, lubrication of the turning mechanism of the boom and cable reels, lubrication of the lifting arm mechanism of the loading cart, lubrication of the lifting arm drum mechanism [1].

Central lubrication of the crawler travel mechanism includes (Table 1): pipeline route between driven tracks and non driven tracks, lubrication of driven tracks, lubrication of non driven tracks.

Table 1. **Lubrication of the crawler travel mechanism**

No.	Name	Number of lubrication points	Lubricant	Lubricant type	Quantity
1	Tracks	147 72	grease UM170LiCa2	central Manual	30kg 30kg
2	Gear drive crawler	3	lubricating oil TIN 82/	Lubricating pump	225 l
3	Intermediate gear	3	lubricating oil TIN 82	Oil pan	195 l
4	Steering mechanism	12 21	grease UM170LiCa2	central manual	
5	Spherical bearings	3 3	grease UM170LiCa2	central manual	
6	Gear steering mechanism	1 4	lubricating oil TIN 125 grease UM170LiCa2	Oil pan manual	20 l
7	Tracks bearings	12 3	grease UM170LiCa2	central manual	
8	Worm gear for steering mechanism	1	lubricating oil TIN 200	Oil pan	0,2 l

The hydraulic system has not undergone major changes in the composition and route. Changes were done on the pump type used and on the type of power feed as ordered. The first excavators, made in Germany, had the BS-B (DELIMON) grease pump type, of German production. Domestic production excavators were equipped

with pump FMVU 1j 22 (R1/2") Subsequently, German and domestic production excavators were equipped with EPU01.400.120.2 pumps type, made by 1 Mai Ploieşti [2].

The EPU 02420.010.2 electro pump type has eight outputs and is powered by a three phase AC electric motor of 0.3 kW. The movement is transmitted to the pump by a two stage cylindrical gear with a ratio of $i = 17$.

The EPU 03.120.013.2 electro pump type consists of the same eight outputs pump but is driven by a planetary gear motor with a M1P1-111, 38-0, 735-1-005-0 gear type, manufactured by IMMUM Baia Mare. The engine power drive is 0.735 kW at the same input speed (1350 r/min.). Having an output speed greater than the gear used in EPU 02.120.010.2 electric pump type (Fig. 2) has a flow rate greater than this.

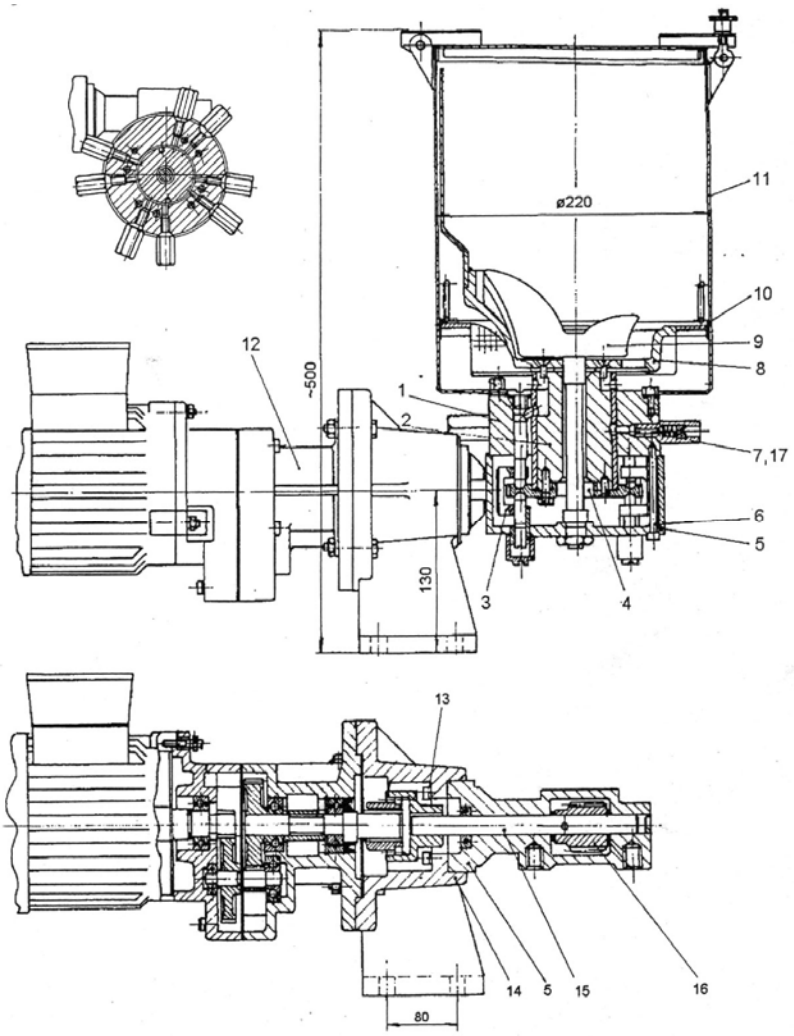

Fig. 2. Metering electro pump for consistent grease EPU 02.120.010.2

All pumps have the nominal pressure of 12 MPa.

Main technical characteristics:

- Nominal pressure: 12 MPa
- Maximum allowable pressure: 15 MPa

Working geometric volume output set to a maximum flow, expressed in cubic millimeters of grease for a rotation of the electric motor (for electro pumps) or for the lever (for manual pumps).

The oil is replaced after approximately 500 hours of operation.

At EPU 02.120 010.2 electro pump types and manual pumps, the gear lubrication, respectively the one-way clutch lubrication is done with RUL145 grease type.

Technical maintenance will be made after every 500 hours of operation. During the maintenance the pump is disassembled, the fitting condition is recreated and, after lubricating the parts with a thin layer of grease, is reinstalled.

3. DEFECTS OF THE METERING PUMPS

During the operation it was found that although the Romanian pumps were new and cheaper, the German pumps were preferred in the pits. The German pumps failures were at a much lower rate than the Romanian ones. Thus, in the end, all upgraded excavators were equipped with BS-B 50/7-FS-400AC-SAV24-OS pump type- with SAV 24-OS inverter distributor track (fig. 3).

This type of pump is driven by a gear motor and works by interlocking, together with the operation of the crawling travel mechanism. In this way, the crawler travel mechanism operation comes into function only after turning on the lubrication electro pump. The following diagram represents the frequency of failures in the two pumps, BS-B50/7-FS-400AC-SAV 24-OS (fig. 3) [3].

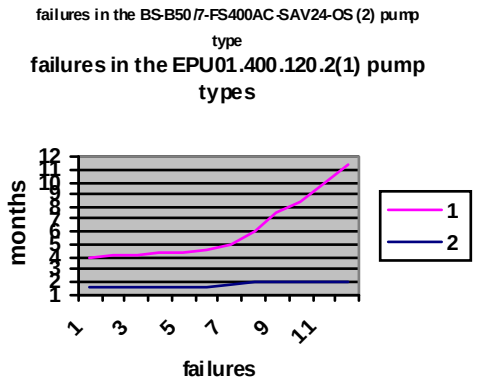

Fig. 3. Pump failures

In some types of excavators the hydraulic installation of the bucket wheel shaft included local lubricators for manual lubrication of the two bearings.

This type of lubrication has proven to be very difficult to achieve in practice (with poor results too).

In upgraded excavators it has been used from the very start a German ZP 5000/VM225.IAL pumps type - (with 15 lubrication heads). Shown in fig. 4 is the failure rate [3].

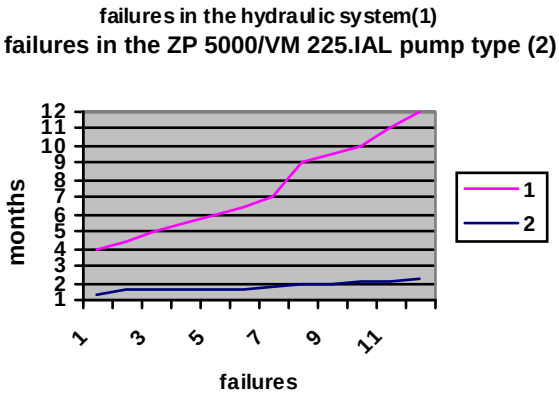

Fig. 4. Failure rate

Considering the relatively large number of worn parts or heavily solicited, the number of defects that can occur individually or simultaneously is high.

Next we present a number of defects found during the operation. If the pump is not primed we find that the pump rotates quietly, without warming up but without pumping out. The causes could be:

a. Direction of rotation is wrong (possible fault only in electro pumps). Reverse the way of rotation of the electric motor.

b. Strainer becomes clogged. Wash it.

c. Grease is too viscous (particularly in cold weather). Grease can be diluted with oil until reaching desired consistency (not less than 1) with the condition that the oil and grease do not react chemically.

Another example of failure is the volumetric efficiency dropped below 0.8. In this case the flow decreases a lot or completely. The causes could be:

a. Play of the piston or distributor is increased beyond limits.

b. Loose plugs or damaged threads.

c. Damaged gaskets.

Remove the blade, mixer and filter and check the plug threads. If the thread is damaged in body is executed another thread for the plug. Gasket is replaced.

4. CONCLUSIONS

The quality indicators of the lubrication systems of the EsRc1400 excavator type respectively maintenance, maintainability and availability, determine the

reliability.

The work done to restore the good running ability of the lubrication systems as part of their maintenance includes all revisions and repairs that can be carried out and it can be done in two directions:

- Preventive - monitoring and periodic reviews;
- Correction - medium repairs and total repairs.

The availability of lubricating systems is affected by two probabilities:

- The operation without failure over a period of time
- Failure and recovery of good functioning over a period of time.

Availability characteristics reflect the ability of these lubricating systems to fulfill their useful functions throughout the life, reason why monitoring and permanently following the planned operating intervals are required, between repairs.

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