

С.Сейфуллин атындағы Қазақ агротехникалық университетінің 60 жылдығына арналған «Сейфуллин оқулары– 13: дәстүрлерді сақтай отырып, болашақты құру» атты Республикалық ғылыми-теориялық конференциясының материалдары = Материалы Республиканской научно-теоретической конференции «Сейфуллинские чтения – 13: сохраняя традиции, создавая будущее», посвященная 60-летию Казахского агротехнического университета имени С.Сейфуллина. - 2017. - Т.1, Ч.3. - Р.68-72

ORGANIZATION OF TECHNICAL MAINTENANCE AND REPAIR OF OPEN-PIT DUMP TRUCKS

Sarsenkyz A.

Career vehicles that provide for the technical operation of dump trucks are usually concentrated in separate units, which could be a [motor-road transport department](#), an auto depot and etc, on department's rights comprises in industrial complex, section or full gallop control [1].

The allocation of the car fleet to the specialized one is explained by both the large number of rolling stock units at large enterprises and the specific nature of service and repair.

Mostly mountain undertakings have own full galloped repair mechanical workshops (RMW) and mobile repair workshops (MRW), where are executed technical service, planned and current repairing.

Even fundamental repair of cars is usually carried out at the mining enterprise due to the lack of a sufficient number of specialized repair factories, the complexity of assembly, disassembly and transportation to the repair site. Because of large dimensions and pressures on the road linen, heavy-duty dump trucks (more than 15 tons) cannot move along public roads. Therefore, the timing of overhauls is largely dependent on local conditions, since repairs consist mainly in replacing faulty units and assemblies with serviceable ones (from a revolving fund). Repair of units and assemblies, in turn, consists in replacement of faulty parts with serviceable spare parts prepared at the enterprise [2].

Industrial base of a modern full galloped property should include: the point of refueling dump trucks with fuel and lubricants, facilities for storing fuel and lubricants, structures for storing vehicles in between-repair times, weekends and holidays, a complex of buildings and facilities for service and repair, Subsidiary and auxiliary premises, contributing to the timely and high-quality performance of works of the main sites, as well as installations for cleaning the body of the dumper.

Storage of dump trucks should ensure the machine's working state in the period between shifts, on weekends and holidays. The autoloader should be ready to work in a complex manner, i.e. All main units and assemblies (engine, oil tanks, storage batteries, etc.) must be heated to the minimum operating temperature.

It may be considered expedient to store dump trucks in closed heated garages, especially in areas with a harsh climate, but this requires significant capital expenditures. With an increase in the carrying capacity, and hence the dimensions of dump trucks and garages, it is natural to reduce the cost of storing machines by equipping open parking lots.

To maintain the temperature of the battery, thermal insulation materials and heating devices can be used both at the dump truck itself and in storage areas. Run dump trucks at low temperatures without engine heating, using non-freezing oils, special fuels and appliances.

At the mining enterprises, stationary group installations are found in the form of special structures in open areas that are not structurally related to dump trucks. The nodes of the dump truck in the open parking lot should be heated in such a way that it does not drain the cooling system (down to -50°C) and do not significantly re-equip the dump truck. The air heating has become widespread, as it provides integrated thermal preparation and there is no need for any additional equipment for car equipment. The air supplied to the dump truck must be heated to a temperature of $80-100^{\circ}\text{C}$. At an ambient temperature of -40°C , the minimum volume of hot air supplied to dump trucks with a carrying capacity of 30-42 tons should be 1000-1500 m^3/h for each dumper.

Electric heating is carried out by means of thermocouples integrated into the water or oil system of motors, which are connected to the mains plugs of the mains.

To facilitate the start-up of engines, special installations are used, powered from an external DC source.

In a number of northern quarries, dump trucks with electric transmission are kept only in open parking areas. Starting the engine does not cause any difficulties: in the three-shift operation mode of the dump trucks during the interchange period, the engines are usually not switched off.

The washing station consists of a preparation section where the dump truck is heated (the difference between the water temperature and the surface of the machine should not exceed $18-20^{\circ}\text{C}$), mechanized washing and drying. The sections are arranged in such a way as to enable the in-line movement of the dump trucks.

In the main production building there are maintenance zones, scheduled and current repairs, repair sites for dumper parts and assemblies (engine repair, transmission, fuel equipment, suspension and tilting mechanism, steering control, and forging welding, copper-radiator and mechanical Sites).

Tire fitting section is a separate unit for repairing tires, chambers, disassembly and assembly of wheels.

Welding sites for body repair, chassis are placed in an open area.

The warehouses of spare parts, materials, exchange units and units are also located in the main production building.

In mobile workshops usually conduct small-scale welding, repair and mechanical work, clean high-pressure systems, supply antifreeze, inflate tires, etc. The most laborious work - operations with large tires. Remove and install the wheels with attachments on forklifts.

On the industrial site of the trucking department, dump trucks come only for service and repair work.

To maintain the required technical level of the dumper in quarries, a system of service and repair of machines is organized.

Service is planned according to the periodicity, the list and the labor-intensiveness of the works performed, and provide for monthly service (MS), and sometimes daily service (DS), first (TS-1), second (TS-2), and for cars with

electromechanical transmission and third TS-3) maintenance, as well as seasonal service (SS) [3].

Service (TS-1, TS-2, TS-3) includes control and diagnostic, fixing, adjusting, lubricating, dismantling, assembly and dismantling works (with removal and subsequent installation of parts of units) and other operations directed on the prevention and detection of failures and damages.

Seasonal service is carried out twice a year, if necessary, to prepare the rolling stock for operation during the cold and warm seasons, combining, as a rule, with TS-2 or TS-3 with the corresponding increase in labor intensity.

The first maintenance (TS-1) is planned after about 125 hours of operation of the engine, but no more than 2000 km of run, the second (TS-2) - after 500 hours of engine operation, but no more than 8,000 km of run, depending on conditions Operation.

For machines with mechanical transmission, the laboriousness of daily maintenance, TS-1, TS-2, current (for 1000 km run) and overhaul is 0.5, respectively; 3.5; 4.7; 6.2 and 40 people-hours. Downtime in the DS, TS-1, TS-2, current repair, respectively, is 0.5; 1.5; 4 and 2 hours, and for major repairs - up to 15 days.

Periodicity, laboriousness and downtime in the service of dump trucks with hydro mechanical and electromechanical transmissions are given in Tables 1 and 2.

The labor intensity of seasonal service is up to 80% of the TS-2 labor intensity for the regions of the Far North and 20-30% for all other regions.

The repair of quarry cars includes a complex of operations to restore the efficiency and resource of the car and its aggregates. The stages of planned repair, similar to the service stages, are formed by combining in one repair of parts and assemblies with close average resource values. Scheduled repairs include the restoration of worn parts and adjustment work.

Table 1 – Technical service of dump trucks with hydro mechanical transmission

Type of service	Periodicity, h	Labor intensity, per.-h	Simple, h
DS	Daily	1,2	1,2
TS-1	125	12,8 (13,1)	6
TS-2	500	57,5 (63,7)	19

Note. Values in parentheses for dump trucks with a load capacity of more than 30 tons.

Table 2 - Service characteristics for dump trucks with electric transmission

Type of service	BelAZ-7549, -7514, -7513			BelAZ -7521		
	Periodicity, h	Laborintensity, per.-h	Simple, h	Periodicity, h	Laborintensity, per.-h	Simple, h
EO	Monthly	0,7	0,7	Monthly	0,8	0,8
TO-1	100	22,5	6	125	31	10
TO-2	500	51	17	500	71	23
TO-3	1000	70	23	1000	98	32
CO	Twice a year	31	-	Twice a year	41	-

Current repairs are carried out as faults occur, and it cannot be scheduled for periodicity and labor. Overhaul of mining dump trucks and their aggregates is designed to restore their efficiency and resource close to full. Major repairs include assembly and disassembly operations and repair of units with a large volume of welding operations (frame, body, brackets).

For dump trucks with hydro mechanical transmission, current and overhaul is provided. The complexity of routine service is 20-23 man-hours per 1000 km of run.

Overhaul is provided through 1200 moto-h (140 thousand km of run), its labor-1100-1350 person-hours.

The initial specifications for periodicity, labor and downtime for service, current, planned and major repairs are given for the so-called standard (averaged) conditions and can be adjusted in specific operating conditions.

The standards of labor intensity of each type of service and repair include the labor-intensiveness standards of previous types.

For dump trucks with electromechanical transmission installed the following types of repair: planned first repair - FR-1, second - SR-2, fundamental (F) and current (C) repairs.

FR-1 is conducted every 4, SR-2 - after 8, F - after 16 - 24 thousand operating hours with the duration of the repair cycle 5 - 8 years. The specifications of labor intensity and downtime in repairs (Table 3) are adjusted depending on the mining technical conditions of operation, and also with the improvement of the design of dump trucks.

Table 3 - Characteristics of repair of dump trucks with electromechanical transmission

Type of repair	BelAZ -7549		BelAZ -7514, -7513		BelAZ -7521	
	Laborintensity, per.-h	Simple, h	Laborintensity, per.-h	Simple, h	Laborintensity, per.-h	Simple, h
Current	21,3 (16,5)	18 (9)	23,2 (18,4)	20 (10)	29,6 (21,6)	22 (11)
Planned:						
FR-1	355	192	405	228	500	276
SR-2	598	336	690	384	840	448
Fundamental	1230	840	1450	960	1700	1080

Note. The values in parentheses are given without taking into account the repair of the tires.

Dump trucks have large overall dimensions and are difficult to execute, therefore, during maintenance and repair, the requirements of safety regulations must be strictly observed.

References

1. Dymasius, A.; Wangsaputra, R.; Iskandar, B. P., «[Analysis of Maintenance Service Contracts for Dump Trucks Used in Mining Industry with Simulation Approach](#)», Конференция: 2nd International Manufacturing Engineering Conference (iMEC) / 3rd Asia-Pacific Conference on Manufacturing Systems (APCOMS) Местоположение: Kuala Lumpur, MALAYSIA публ.: NOV 12-14, 2015 2ND INTERNATIONAL MANUFACTURING ENGINEERING CONFERENCE AND 3RD ASIA-PACIFIC CONFERENCE ON MANUFACTURING SYSTEMS (IMEC-APCOMS 2015) Серия книг: IOP Conference Series-Materials Science and Engineering Том: 114 Номер статьи: 012063 Опубликовано: 2016
2. Под ред. Замышляева В.Ф. Техническое обслуживание и ремонт горного оборудования: Учебник. – М.: Издательский центр «Академия», 2003. – 400с.
3. Ящура А. И. Система технического обслуживания и ремонта общепромышленного оборудования: Справочник. – М.: Изд-во НЦ ЭНАС, 2006. – 360с.