UDC 622.75:629

INFLUENCE OF OPERATION CONDITIONS ON RELIABILITY PARAMETERS OF TRACTORS ASSEMBLY UNITS

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Questions of influence of operation conditions on reliability parameters of assembly units of tractors are considered, actions for increase of maintainability of assembly units are developed.

Key words: the engine, operation, repair, distribution, a resource.

Entry. Influence of external environments largely determines the size of indexes of longevity of component parts of tractor and, in particular, its resource to major repairs.

Problem. Being one of major parameters of machines reliability, a resource to major repairs can cover a cost not only indexes of technical perfection of machine-building production but also by certain description of level of machines technical exploitation [1,2,3,4]. So in the real exploitation level of of exploitation quality determines the value of their reliability indexes.

The purposes of researches: As in tractors the most expensive and difficult component part is an engine and at the same time their reliability indexes are lower than other component parts, then estimation of reliability of tractor engines and factors, that determine it, are important and actual.

Results of researches. The estimation of up to repair resource and level of technical exploitation is considered on the example of the real exploitation of engines of СМД- 62. As diesels that were stopped to trial (Пр), during further work would attain the maximum state with equal probability on any segment of exploitation, then calculation numbers of given up diesels (taking into account stopped),were determined by the method of Johnson. Treatment of information on the up to repair resources of diesels was conducted by the method of co-ordinate points [4,5,6]. As a theoretical law of distribution is beforehand unknown, then integral lines were investigated jointly for the law of normal distribution (LND) and distribution of Veybula (LDV). Verification of coincidence of the investigated and theoretical distribution was conducted on the criterion of consent of Pirsona (X^2), that showed that more used is LDV with parameters: A = 4571 motohours, B = 1,3 and З = 3,28 motohour. Thus, differential function of closeness of distribution of up to repair resource of diesel СМД- 62 has a next kind:

$$f(t) = 0,007 \cdot 1,3 \cdot (t - 3,28)^{0,3} \cdot 1^{-0,007 \cdot (t-3,28) \cdot 1,3} \tag{1}$$

It is set as a result of analysis, that middle resource of engine СМД- 62 in the real terms of exploitation is 80 % of the set resource. Underultilization of the technical resources incoperated in the design of engines is one of basic lacks of the real exploitation. The large number of engines is directed in major repairs. By reason there is a lack of awaiting-parts of certain nomenclature, necessary for support of normal work of engines, that is not high technical equippment of services of exploitation, and also the lack of ability of mechanization experts correctly estimate remaining resource. Large influence on the size of resource of up to repair diesels gives a failure to observe periodicity and nomenclatures of operations of technical service. On the basis of information about actual periodicity TO it was set that for TO - 1 and TO- 2 periodicities theorelically is described LDV with the closeness of distribution of kind :

For $f(t) = 0,105 * 1,66\, t0,66 * t^{-0,105t1,66}$, (2)

For $f'(t) = 0,018 * 2,5\, t1,5 * t^{-0018t2,5}$. (3)

The average freguncy of operations TO - 1 made 348 motohours, and TO- 2 -445 motohours, that is actual periodicity of TO - 1 almost in 6 times, and TO- 2 - almost in 2 times (at the set periodicity TO for the tractors of these years of producing; TO - I - 60, TO- 2 - 240 and TO- 3 - 960 motohours). Thus plenitude of implementation of operations of TO - I made 78%,TO-2 - 64% of volume envisaged by instruction for exploitations. Thus, failure to observe periodicity and plenitude of implementation of operations TO diesels is one of factors that result in the decline of their reliability indexes. As known, the important stage in the process of support of tractors level of reliability in the conditions of exploitation is adjustment of their constructions to permanent repair (to the removal of consequences of refuses and disrepairs). It assists also to development of tendency that was set lately, to the increase of tractors lifetime before overhaul. It is often enough to conduct replacement of component parts that are out of order , in terms of agricultural enterprises or frame-clamping units and a tractor becomes capable of working. That is the insistent necessity of more wide introduction of aggregate-key method of repair of tractors or more precisely major repairs exactly of their component parts and frame-clamping units appears. Therefore adjustment of tractor to the rapid and comfortable assembly and disassembly   of out order component parts,   frame-clamping units and their elements, when restore of the lost capacity is achived due to their replacement, most fully is characterized by availability to the places of service and repair. In these cases basic labour charges are determined by the complex of demountable and frame-clamping works and, thus, access grows into an important factor that characterizes maintainability. Depending on reduction of influence of access factor   the values of labour intensiveness of removal will go down in one or another measure. It is known that maintainability depends on good few of design-engineering factors that formulate property of adjustment of tractors construction to technical service and repair. These include: complication of construction, availability to the places of greasing, adjusting of details, adjustment to control of the technical condition, self-regulation of devices, easy remove of component parts, adjustment to replacement of component parts and frame-clamping units; unitization of component parts of

tractor, timber details, instrument; interchangeability of component parts of tractor; adjustment to lifting work , adjustment to transporting, readjustment and canning. The organizational side of improvement of properties of maintainability largely depends on operating factors, thery are : operating conditions and maintenance; qualification of mechanization experts that execute technical service and repair; a presence of awaiting-parts; a provision of instrument, adaptations and repair equipment; technologies of service and repair; the personal interest of mechanization experts and others like that. In the process of removal of refuses of tractors in exploitation the most comfortable indexes, that characterize its change, are following, : middle operative labour intensiveness of removal of refusal consequences , resulted to one tractor:

$$S = \frac{\sum_{i=1}^{n} S_i}{N} \qquad (4)$$

where N - is an amount of tractors; S_i is labour intensiveness of removal of refuses of i- tractor;

Кд is a coefficient of availability :

$$K_{Д} = \frac{S_{осн}}{S_{осн} + S_{доп}} \qquad (5)$$

were $S_{доп}$ is labour intensiveness of additional works; $S_{осн}$ is labour intensiveness of implementation of a special purpose work.

Not all component parts of tractor identically are well adjusted to the removal of refuses in exploitation. Yes, the analysis of change in average operative labour intensiveness of removal of refuses, for example the wheeled tractor of class 3, testifies that its distribution is described by an exponential law.

$$F(s) = \lambda e^{\lambda s} = 0,017 e^{-0,0173} \qquad (6)$$

where λ = const is a parameter of distribution.

Verification of hypothesis of co-ordination of empiric distribution with the theoretical exponential law of distribution with the use of criterion of Kolmogorova - Smirnova showed, that with authenticity of P = a 0,32 hypothesis is not rejected. The least part of labour intensiveness of removal of refuses falls on the working system, electrical equipment, devices, booth and plumage, auxiliary aggregates of engine and aggregates gidro hanging system (at the simultaneous improvement of availability to these frame-clamping units) in relation to labour intensiveness on the whole on a tractor [8,9,10]. The decline of refuses is attained by introduction of design-engineering measures, and also by the improvement of terms of technical service and repair. For example, in the process of modernisation of the wheeled tractors there were removed refuses on stratification of tires of wheels due to the increase of number of layers of framework; the wring of fists of

muff of pump gidro hinged systems. Refuses on the origin of flow through the butt-end compressions of the wheeled reducing gear were lowered by introduction of rubber cuffs. The chaffy of isolations of bunch of send-offs is removed due to the change of its route. However the labour intensiveness of removal of consequences of refuses on an engine and transmission requires a further decline. Most adjusted to the removal of consequences of refuses is: - engine is the system of an air cleaner , system of greasing, turbo-compressor, starting system; it is an engine - at relatively small frequency of refuses display of stop screws of pushers of pumping sections of petrolifts (of (11,1%) labour input of their removal, in relation to labour intensiveness of removal of all refuses of stuff wares, is the highest (72%) that is, introduction of measures in relation to the removal of this refuse gives a substantial decline to labour intensiveness of removal. In addition, this fact testifies to insufficient repair technologicalness of this unit, at the same time labour intensiveness of replacement of ventilator strap, most frequent refuse (29,6%), is 8,8%, testifies to satisfactory repair technologicalness of this operation. Although frequency of display of gaskets destruction of pumping sections of petrolifts (3,7%), however the labour intensiveness of their removal is high enough (16,0%); transmission by - high labour intensiveness of removal (62,5%) is characterized

refuse of compression of reasons of back semiaxis, frequency of its display was 40%. Somewhat lower (37,5%) at frequency of display (60%) is labour intensiveness of replacement of bearing of drive; it is the working system - at identical frequency of display (27,7%) labour input of replacement of protector of tires of back wheels is 13,8% versus labour intensiveness of replacement of protector of tires of forewheels (26,2%). Often (40%) it is represented oil flowing on compression of lid hydrocylinder, although labour intensiveness of replacement of compression does not exceed 7,5%.- electrical equipment and device - frequency of display electrical equipment refuse does not exceed 3,2... 13,1% with exception of electric tubes replacement of that takes place in 50,9%. The labour intensiveness of removal of these refuses is within the limits of 3,2...25,4%. - is an auxiliary equipment of engine - all 100% refusal is on intumescing and break of the cooling system hoses - a booth and elements of plumage are a characteristic display though small (0,02%), of precipice of rubber profile of screen-wiper brush .

Conclusions. Influence of external environments to some extent affects change of value indicators of maintainability and, in particular, labour intensiveness and duration of removal of refuses. By reserve of labour intensiveness decline at repair there can be an improvement of adjustment to replacement of compressions of water pump, crankshaft, clutch, reducing gear of starting engine and maintainability of constructions, but simultaneously by the improvement of organization of technical service and repair (TO) of tractors, their exact use. Rationally combining these possibilities, it is possible stage-by-stage, as far as perfection of tractors construction and improvement of organization of their technical service and repair to attain reduction of running expenses on repair of tractors for consumers. In this direction timely measures have a certain role in

relation to studies and in-plant training of mechanization experts, providing of economies by the necessary assortment of oils, some improvement of level of technical service. It can be attained, first of all, due to reduction of the volume of additional operations, that provide access to the commutable element or frame-clamping unit, and also to the improvement of quality of collection, adjusting of frame-clamping units and other measures that promote faultlessness of work of component parts. The important factor of forming of external terms that determine the wear of frame-clamping units of tractors is their employment on the different types of agricultural works. Therefore for the estimation of terms of tractors work in exploitations that determine character and size of abrasive wear its frame-clamping units, it is necessary to have in the order information about employment of tractors on the different types of agric. works for maybe greater period of their use. In the absense of obvious signs of limit state the technical state is estimated on a resource requirement.

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ВЛИЯНИЕ УСЛОВИЙ ЭКСПЛУАТАЦИИ НА ПОКАЗАТЕЛИ НАДЕЖНОСТИ СБОРОЧНЫХ ЕДИНИЦ ТРАКТОРОВ

Уминский С.М., Конев С. В.

Ключевые слова: двигатель, эксплуатация, ремонт, распределение, ресурс.

Резюме

Рассмотрены   вопросы влияния условий эксплуатации на показатели надежности сборочных единиц тракторов, разработаны мероприятия по повышению ремонтопригодности   сборочных единиц.

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Summary

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