Не тільки купити хорошу сільгосптехніку, але і не залишитися на самоті в разі виникнення проблем. На щастя, компанії, які володіють світовими брендами, це давно усвідомили, тому дуже ретельно обирають дилерів та постачальників послуг , не дозволяючи нікому продавати чи обслуговувати своє обладнання .

Головною перевагою бренду Case IN є компетентний і потужний технічний сервіс. Особливо цим займається спеціалізована компанія «Титан». Машини, які працюють у всьому світі, в тому числі і в нашій країні. У компанії великі плани щодо розвитку сервісної інфраструктури. Це мають бути сучасні, комплексні та високопрофесійні дилерські центри американського типу , які будуть створені в кожному регіоні, а також мережа складів, салонів і ремонтних майстерень для всіх видів запчастин, послуг і обладнання.

Крім того, у Case IN є й інші сильні партнери в Україні – наприклад, корпорація «НовоФарм» створила механізовану установку за технологією Case IN для допомоги аграріям під час посіву та збирання врожаю . У цій механічній бригаді 50 тракторів. Після того, як техніка відпрацює два-три сезони, «Новофарм» продає її як є і проводить технічне обслуговування. За таких обставин зрозуміло, що купити трактор Case IN можна, не боячись його зламати.

Тому, завдяки всім гарантіям сучасного дизайну та сервісу, не дарма трактори брендів CNH та CASE IN цієї компанії займають друге місце за купівлею в Україні (28%) після тракторів John Deere (34%).

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## ENSURING FUEL ECONOMY AND ENVIRONMENTAL QUALITIES OF DIESEL ENGINES IN LIGHT LOAD MODES

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*The analysis and systematization of the factors affecting the qualitative power and economic indicators of the transport diesel engine were carried out; thermal calculation of diesel without turbocharging and with turbocharging, comparison of their power and fuel consumption indicators. The analysis of battery fuel supply systems and their functional capabilities for controlling the fuel injection process, the choice of diesel fuel equipment, which provides a change in the working volume of the diesel by turning it off and on, was carried out.*

***Key words:*** *engine, fuel, consumption, fuel supply, cylinder.*

**Problem.** In conditions of limited financial and material resources, the problem of technical rearmament of agricultural production cannot be solved only by increasing the supply of new equipment. A significant role in this process is assigned to the reasonable use of the available fleet of

machines, maintenance of its technical level with the help of qualified maintenance and repair. Repair of units with restoration and strengthening of parts is a technically sound and economically justifiable measure. It allows repair and maintenance enterprises and farm workshops to reduce downtime of faulty machines and equipment, improve their reliability and use. The experience of operating hydraulic machines has shown that their share accounts for 17-30% of failures of the entire hydraulic system. Some agricultural enterprises are forced to carry out repairs on their own. At the same time, due to the lack of experience, technology and equipment, the resource of repaired units often does not exceed 30–60% of new resources. In connection with the above, the development and implementation of a new repair technology, based on the use of polymer parts made of highly effective anti-friction composites based on kaprolon (polyamide) in the tribo connections of power hydraulic cylinders, will allow to reduce the cost and repair time, significantly increase the reliability of the entire hydraulic system of agricultural machinery [1 -3].

**Analysis of research and publications.** The reliability of modern tractors and other agricultural machines is largely determined by the reliability of hydraulic units. Some enterprises are forced to carry out repairs on their own. A hydraulic cylinder is a three-dimensional hydraulic motor in which the driven link (rod, plunger, shaft) makes a limited reciprocating movement. They can transmit the developing force in only one direction. The unevenness of wear of the friction surfaces is characteristic of tribo-joints (guides) for the translational movement of power hydraulic cylinders due to the fact that contact cannot be made over the entire friction surface. Distortion of the shape of the surface during its wear disrupts the correct operation of connections. In this case, the shape of the worn surfaces of the tribocoupler elements does not depend on the materials, including the materials they are made of, as on the acting forces, the nature of the relative movement, their configuration and dimensions. Reversible movement causes in the surface layers of contacting bodies sign-changing shear deformations, i.e. successive changes in compression and tension zones, which leads to some increase in the frictional force and elastic deformations outside the contact of tribocombination materials. Reversible movement changes the nature of plastic deformation. Variable deformations lead to an intensive process of formation of structural defects. Enhanced development of micro- and macrodefects contributes to the course of processes of diffusion, adsorption and chemisorption interaction of friction surfaces [1].

**Research results.** As the rubbing surfaces of the elements of the hydraulic cylinder wear out, which again leads to an increase in its total deformation, respectively, to an increase in the acting longitudinal and transverse loads, the operating conditions of the hydraulic cylinder deteriorate with greater intensity [2], the consequence of which is a decrease in its efficiency as by bearing and sealing (due to the failure of sealing systems) capacity. It is obvious that for hydraulic cylinders with a one-sided rod, in the presence of a significant stroke and longitudinal dimensions, a significant increase in the accuracy of the "piston - sleeve", "rod - guide" tribo-combinations is necessary during timely repair, which consists in changing the guide elements (if they are present in the design) or restoration of worn surfaces (in their absence). The most common in tractor hydraulic drives are double-action piston hydraulic cylinders of the Z series. These hydraulic cylinders are similar in design, but differ in the sizes of sleeves, pistons, and rods. One of the main disadvantages of their designs is the absence of replaceable guide bearing rings in the rod and piston units, which reduces the inter-repair resource and increases the complexity of repairing hydraulic cylinders [3]. The reliability of hydraulic cylinders is affected by such operational factors as: temperature, contact pressure, presence of vibrations, speed of movement of working parts. The listed parameters result in a total change in the physical and mechanical properties of seal materials, the accumulation of fatigue damage, wear and, ultimately, the destruction of the surface layers of tribocombinations. The loading mode is determined by the amount of load in the hydraulic system, the number of cycles and the duration of work under pressure when performing various operations by the equipment. The evaluation of the operating mode is carried out by determining the degree of load for one cycle of operation, the number of inclusions per unit of time, the use of nominal pressure, temperature of the working fluid, ambient air, etc. The nature of wear and tear of parts of tribo-joints of hydraulic cylinders and operating conditions can be divided into three periods: the first is the time from the moment of detachment of the working body

(mounted machine) to the balanced state; the second - from a balanced state to moving the working body in space; the third is the time from the movement of the working body in space to its stop [2]. In the first period, the impact moment and forces tending to displace the rod from the axis lead to deformation of the rod. The second period of work is characterized by a sharp deterioration in the working conditions of the lubricant, which leads to an increase in the force of friction at the time of movement of the working body. All these factors contribute to an increase in the wear of sealing units, the occurrence of burrs, internal stresses in the metal, and bending of the rod. During the third period, the resource of the hydraulic cylinder is reduced due to the entry of high-viscosity cold oil into the friction surfaces, which worsens the wedging of the surfaces of the tribo-joint elements. There are two possible ways to solve the problem to restore the performance and increase the durability of power hydraulic cylinders:

1) restoration of worn surfaces of parts in moving units by applying anti-friction metal coatings, the tribotechnical parameters of which exceed the given parameters of the materials of new typical parts;
2) changing the design of tribo-joints by installing in the cover and piston of hydraulic cylinders guide support rings made of wear-resistant polymer composites [2], which will lead to a significant reduction in the intensity of wear of parts of resource-determining joints and a decrease in the labor cost of repairing hydraulic cylinders. To further reduce the wear of the specified parts of the hydraulic cylinder, passive (rubber cuffs) or active (round rubber rings) seals are replaced with combined type sealing elements that have significantly greater wear resistance and resistance to mechanical damage [3]. The combined seal includes two parts, one of which (rubber ring of round or square section) performs the function of a power element, creating the required level of contact stresses on the two sealing surfaces. Another part, made of wear-resistant polymer composite, is a direct sealing element. In the designs of modern hydraulic cylinders, as mentioned above, guide and sealing elements made of polymer composite materials are introduced into the design to increase the resource. Polyimides have high radiation and chemical resistance, good tribological properties and can be operated for a long time at a temperature of 220–260°C. Materials including polyimides work satisfactorily in high vacuum conditions (up to 10-4 Pa). Polyimide friction parts are obtained by hot pressing. Ultrahigh molecular weight polyethylene is a promising material for tribojoint parts, which has a unique set of elastic strength and tribological properties. According to a number of studies [1, 3], a significant share of gradual failures of power hydraulic cylinders is associated with the wear of their parts and makes up more than 70% of the total repair fund of hydraulic cylinders. At the same time, the 80% gamma resource of new hydraulic cylinders is equal to 5440 hours of tractor operation, which is 1.5 times lower than the resource declared by the manufacturer. The dominant influence on the reliability of hydraulic cylinders is provided by operational factors, including force interactions of tribo-joint parts. the performance of the hydraulic cylinder is significantly influenced by the power mode of operation, which leads to the occurrence of significant reactions on the part of the cylinder cover and sleeve. At the same time, the magnitude of the reactions in the forward position of the piston is almost six times greater than the reactions realized in the rear position. All this leads to the occurrence of significant wear of the working surfaces of the connected parts in the vertical plane and the increase of clearances in the movable sealing units. In turn, the growth of clearances leads over time to the formation of a significant deflection of the hydraulic cylinder in the vertical, as a result of which there is an increase in reactions in the triboconnections, which leads to an even greater increase in contact stresses and intensification of wear. According to the research results, to restore the serviceability of the piston assembly and the front cover when repairing the hydraulic cylinder, it is proposed to change its design with the installation of guide support rings made of polyamide composite in the cover of hydraulic cylinders, which will lead to a significant reduction in the intensity of wear and tear and reduce the complexity of repairing hydraulic cylinders.

**Conclusions:** It is shown that the method provides an increase in cyclic feeds, and therefore their quality, a decrease in the coefficient of excess air, an increase in the thermal state of the active cylinders, which determines the possibility of increasing the efficiency and environmental friendliness of diesel engines in such modes. An analysis of the possible change in mechanical losses in the diesel engine in case of disconnection of some cylinders was carried out. It is shown that the

majority of actually used methods of experimental determination of mechanical losses are based on the use of cylinder disconnection. The assumption that in the conditions of implementation of low-load regimes, the absolute values of mechanical losses depend only on the speed regime and do not depend on the number of disconnected cylinders is substantiated.

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## ОЦІНКА ВПЛИВУ ЧИСЛА РЕЗЕРВНИХ КОМБАЙНІВ НА ЗАБЕЗПЕЧЕННЯ ТЕХНІЧНОЇ ГОТОВНОСТІ ЗБИРАЛЬНИХ ТЕХНОЛОГІЧНИХ ЛАНОК

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Технологічна тривалість збирання зернових колосових культур залежить від таких факторів, як організації роботи технологічних комплексів, кількісного складу і технічного стану збиральної техніки, транспортних засобів, виробничо-погодних умов, технологічного та технічного забезпечення виробничого процесу та ін.. Ефективне використання і якісний технічний сервіс техніки технологічних комплексів – є одними із найголовніших напрямків підвищення продуктивності збиральної техніки та зменшення собівартості збирального технологічного матеріалу.

**Постановка проблеми.** Одним з основних завдань збирального технологічного процесу на збиранні зернових колосових культур – зібрати максимум вирощене зерно – урожай та зменшення його втрат. Цього можна досягти, якщо технологічний процес збирання зернових культур проводити в оптимальні агротехнічні строки за допомогою раціональної організації збиральних робіт стосовно технологічного, технічного забезпечення та виробничих особливостей кліматичної зони збирання [1]. Також ефективність функціонування технологічних комплексів тісно пов'язана з параметрами системи технічного сервісу техніки, а оцінка по них дозволить визначити найкращі рішення. На зменшення терміну збиральних робіт впливає також термін часу на усунення наслідків відмов збиральної техніки [2]. Це можна досягти поліпшенням роботи ланки технічного сервісу з усунення відмов збиральної техніки та застосування методів резервування ресурсів.

*Мета дослідження.* Обґрунтування способів технічного сервісу збиральної техніки технологічних комплексів для зменшення простоїв зернозбиральних комбайнів та підвищення їх продуктивності.

**Основні матеріали дослідження.** В умовах інтенсивної й напруженої роботи технологічних комплексів (ТК) на збиранні зернових колосових культур, коли технологічний процес і роботу збиральної техніки бажано не зупиняти – технічний сервіс та усунення відмов комбайнів може бути організовано по двом схемам [3]. Технічний сервіс та усунення відмов комбайнів проводять на резервних комбайнах у підготовчому циклі – перша схема, а також в