

THE IMPORTANCE OF THE APPLICATION OF PROTECTIVE COATINGS IN INCREASING THE SERVICE LIFE OF AGRICULTURAL TECHNIQUES USED IN THE AGRICULTURAL ENVIRONMENT

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Abstract

Machines manufactured in mechanical engineering operate under very diverse conditions. In this case, protective coatings, in addition to general factors, are subject to specific (special) effects, mostly aggressive factors. Therefore, the study of protective coatings is considered important.

Keywords: Aggressive environment, machinery, mechanism, durability, factor, coating, requirement, protection level, adhesion, storage.

Introduction

It is well known that agricultural machinery directly exposed to harsh and aggressive environments must be protected from the negative effects of such environments; otherwise, the working parts of the machinery will quickly become unusable.

Agricultural mechanisms that operate in aggressive environments include tractors and trailers attached to them (cultivators, soil crushers, and the metal parts of devices for distributing mineral and organic fertilizers).

Protecting machine parts and components from a harmful environment increases their operational suitability indicators, prolongs the service life of the equipment, and provides economic efficiency. If protective coatings are regularly applied during each storage season, the thickness of the metal and its resistance to wear do not significantly decrease. Thus, year by year, wear costs remain almost unchanged, and the efficiency of machine parts improves.

In mechanical engineering, machines and mechanisms operate in a wide variety of conditions. Protective coatings are influenced not only by general factors but also by specific and aggressive factors. Therefore, a durable coating system must be used that meets the requirements of various conditions.

For this purpose, the assortment of paint-and-lacquer materials must be diverse and meet the following requirements:

- ability to be applied under different temperature ranges;
- ease of preparation of metal surfaces before coating;
- achieving the desired level of protection with a minimum number of layers;
- maximum compatibility of different coating materials;
- minimal harmful effects of toxic substances on workers during preparation and application;
- resistance to chemical substances, lubricants, coolants, and cleaning agents;
- durability under high and low temperatures and various external impacts;
- resistance to wear and fluctuating loads;
- chemical and biological stability, as well as safety for food products, etc.

In agriculture and industry, ensuring high-quality preparation of metal surfaces for coating is just as important as the durability of the protective coating itself. The effectiveness of protective coatings is determined by the cleanliness of the metal surface, its barrier properties against aggressive environments, and resistance to corrosion.

When evaluating protective coatings, factors such as adhesion, impact resistance, elasticity, etc., are tested under experimental conditions. Based on research results, accurate data were obtained.

Table 1. Corrosion rate (g/cm²) and relative corrosion resistance of steels in fertilizers

Fertilizer	Steel-3	Steel-35	Steel-45	Steel-45X	Steel-65G
Ammonium nitrate	340 (1.00)	494 (0.69)	522 (0.65)	617 (0.55)	541 (0.63)
Granulated superphosphate	338 (1.00)	928 (0.79)	751 (0.96)	465 (0.73)	318 (1.07)
Urea	342 (1.00)	368 (0.93)	371 (0.92)	235 (1.46)	356 (0.96)
Simple superphosphate	359 (1.00)	446 (0.80)	372 (0.97)	489 (0.74)	343 (1.04)
Sylvinit	547 (1.00)	656 (0.88)	602 (0.96)	541 (1.06)	589 (0.98)
Ammonium sulfate	1055 (1.00)	1308 (0.81)	1294 (0.82)	1938 (0.54)	2032 (0.52)

When agricultural machinery parts working in aggressive environments are left unprotected, their service life decreases by 2–3 times due to corrosion. This reduction in service life during operation and storage causes significant losses for agricultural enterprises.

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