ENERGY-SAVING PAINTS AND VARNISHES AND COATINGS FOR AGRICULTURAL MACHINERY

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Abstract

The choice of paints and varnishes and painting technologies for agricultural machinery is made taking into account its purpose and operating conditions. Therefore, when choosing a painting technology, it is necessary to take into account the weather resistance of the resulting paintwork, oil resistance, petrol resistance and heat resistance, as well as chemical resistance and non-toxicity, depending on the operating conditions. According to the authors, the standards of applied paintwork materials are outdated, since in recent years better and more durable materials have appeared on the market. SPA Lakokraspokrytie offers as an alternative fast-drying energy-saving alkyd-urethane, urethane and alkyd-acrylic paintwork materials and also offers a two-layer energy-saving dyeing technology.

Keywords: Paints and varnishes, paintwork, dyeing technology, agricultural machinery

1. INTRODUCTION

The choice of paints and varnishes and painting technologies for agricultural machinery is made taking into account its purpose and operating conditions.

By purpose, agricultural machinery can be divided into three classes [1]. The first includes tractors, engines and self-propelled chassis. The second class includes tillage machines, machines for sowing and planting, for preparing and applying fertilizers, for protecting plants, for irrigation, various types of combines, headers and trailers for transporting goods, machines for cleaning grain and seeds, harvesting and processing vegetables, as well as machines used in gardening. The third class of agricultural machinery includes equipment for animal husbandry and forage production.

Agricultural machinery of the first and second class is operated in atmospheric conditions. Therefore, when choosing a painting technology, it is necessary to take into account the weather resistance of the resulting paintwork. For parts and assemblies exposed to gasoline, mineral oils and high temperatures, oil, petrol and heat resistant materials are selected. Machines and equipment for applying fertilizers, as well as for livestock complexes, must have chemically resistant paintwork. In addition, paint products for the protection of the livestock complex should be non-toxic, should not affect the reproductive functions of animals and reduce the sanitary characteristics of the received food.

2. PRACTICAL PART

Currently, the choice of paint and varnish materials and the technology of their use is regulated by GOST 6591-91 "Coatings for paint and varnish tractors and agricultural machines. General technical requirements "and GOST 23852-79" Paint coatings. General requirements for the choice of decorative properties ".

So, for example, facing parts of agricultural machines must have a coating class of at least IV-V, on the remaining surfaces a VII coating class is allowed according to GOST 9.032-74. Coatings should be smooth, glossy or semi-glossy. According to the color scheme for agricultural machinery, red, orange, yellow, blue and blue colors are selected.

For painting agricultural machinery in accordance with GOST 6591-91, weather-resistant enamels such as AC-182, PF-115, PF-188, ML-152, XV-518, XC-758 and others are recommended. Priming, as a rule, is made with alkyd primers GF-0119, GF-021, GF-017. These are energy-intensive LMK with high-temperature (80-110 ºC) and long-term drying (from 35 to 90 minutes). It should be noted that until now, many manufacturers of agricultural machinery use PF-115 enamel for coloring their products, despite the fact that, according to GOST, the period of application of this enamel is limited to 01.01.1994. The above paintwork has a service life in temperate and cold climates up to 5 years. Higher service life (up to 7 years) is provided by coatings primed with water-borne materials applied by electrodeposition, dipping and spraying (primers V-KF-093, V-KCh-0207, V-ML-0143), as well as powder coatings.

In our opinion, this standard is outdated from the point of view of the applied paints and varnishes, since in recent years better and more durable materials have appeared on the market.

In foreign practice, trends in the development and application of paintwork for agricultural machinery are:

- replacement of conventional paintwork materials with paintwork materials with a high solids content and with water-based materials;
- application of formulations without harmful air pollutants;
- minimization of the amount of VOCs;
- optimal compatibility of application methods;
- obtaining high-quality paintwork at lower costs.

For example, on a new painting line for potato diggers at the Grimme Landmaschinenfabrik plant, since 1995, products have been painted by dipping followed by powder coating. Surface preparation was carried out by iron phosphating. In 2003, iron phosphating was replaced by zinc phosphating, and dip priming was replaced by a thick layer (up to 45 microns) cataphoretic priming.

The German company Eisenmann for the Czech Republic develops and installs a painting line for agricultural machines with 11 zones for surface preparation by cataphoresis followed by a coating layer.

At the John Deere Werke plant (USA), a fully automated line for painting agricultural equipment with the quality of painting a car was launched. The painting line includes a 13-stage surface preparation, cataphoresis priming followed by painting with acrylic powder coatings.

The rise in energy prices both abroad and in Russia leads to the need to save electricity. The problem of energy saving abroad is solved through the rational loading of the painting line, the use of diagonal ventilation systems in the painting and drying chambers, the use of heat exchangers to use the recovered heat, for example, for heating surface preparation baths, heat recovery from drying chambers, the use of special sliding gates for maximum heat preservation [2-4].

In Russia, energy savings are mainly solved through the use of energy-saving paintwork materials [5]. Such energy-saving materials include alkyd-acrylic, urethane, acrylic-urethane materials, which are currently widely represented on the Russian market [6].

The assortment of paints and varnishes, produced by SPA Lakokraspokrytie, also includes fast-drying energy-saving alkyd-urethane, urethane and alkyd-acrylic paintwork materials.

The paint systems for painting agricultural machinery based on these materials are shown in **Table 1**.

Table 1 Paint systems

Name of parts and assembly units	Paint systems	
	For temperate and cold climates	For tropical climates
Roofs, shields, hoods, sidewalls, walls, sides, casings, belts, sheets, cyclones, selectors, sorters, cabinets for spare parts, consoles, etc. Frames, pages, frame structures, trailers, beams, headers and trailers platforms, etc. Bins, bodies, boxes, trays, auger casings, elevators, etc.	Gr. AU-0179 1x20 Em. AU-1518 2x25 70 μm Gr-um. AU-1-201 1x40 Em. AU-1518 1x25 65 μm Gr-um. AU-1-201 2x40 80 μm Gr. "Victoria" 1x20 Em. AS-1-228 2x25 70 μm	Gr. UR-0442 1x30 Em. UR-1524 3x20 90 μm Gr-um. UR-1-202 1x35 Em. UR-1524 3x20 95 μm
Ladders, railings, driver's platforms, seat frames and supports, etc. Lattice mill, stacker bottom, fan blades, rakes, brackets, etc. Details and units of pick-ups, tedders, etc. Augers, shafts, combs, conveyor strips, etc.	Gr. AU-0179 1x20 Em. AU-1518 1x25 45 μm Gr-um. AU-1-201 1x40 40 μm Gr. "Victoria" 1x20 Em. AS-1-228 1x25 45 μm	Gr. UR-0442 1x30 Em. UR-1524 2x20 70 μm Gr-um. UR-1-202 1x35 Em. UR-1524 2x20 75 μm
Sheets, sheathing, panels, beams, pump bodies, tanks, etc. Machines for sowing, plant protection and watering machines.	Gr. "Victoria" 1x20 Em. AS-1-228 2x25 70 μm	Gr. UR-0442 1x30 Em. UR-1524 3x20 90 μm
Drying drums and columns, casings of heat generators, casings of electric heaters, casings of electric motors and other agricultural dryers, machines for processing feed and wet feed.	Gr. AU-0179 1x20 Em. AU-1518 1x25 45 μm Gr-um. AU-1-201 1x40 40 microns Gr. "Victoria" 1x20 Em. AS-1-228 1x25 45 μm	Gr. UR-0442 1x30 Em. UR-1524 2x20 70 μm Gr-um. UR-1-202 1x35 Em. UR-1524 2x20 75 μm
Parts and units of conveyors for working with manure. Tanks, bunkers, tanks, reservoirs, water cannons, etc. Machines for plant protection.	Em. EP-5287 2x25 50 μm Em. EP-773 2x25 50 μm	Em. EP-5287 2x25 50 μm Em. EP-773 2x25 50 μm
Fuel, gasoline tanks.	Gr. UR-0442 1x30 Em. UR-1524 2x20 70 μm	Gr. UR-0442 1x30 Em. UR-1524 2x20 70 μm
Parts and assemblies of the running gear, axles, cardan shafts, hydraulic cylinders, parts and assemblies of the hydraulic system, air cylinders, etc. Housings for gearboxes, gearboxes, etc.	Gr. AU-0179 1x20 Em. AU-1518 1x25 45 μm Gr-um. AU-1-201 1x40 40 microns Gr. "Victoria" 1x20 Em. AS-1-228 1x25 45 μm	Gr. UR-0442 1x30 Em. UR-1524 2x20 Gr-um. UR-1-202 1x35 Em. UR-1524 2x20 75 μm
Running wheels, skids, half-track, working bodies (disks, rollers, etc.)	Gr. AU-0179 1x20 25 μm Gr. "Victoria" 1x20 20 μm Em. AU-1518 1x25 25 μm Gr-um. AU-1-201 1x40 40 microns Em. AS-1-228 1x25 25 μm	Gr. UR-0442 1x30 Em. UR-1524 3x20 90 μm Gr-um. UR-1-202 1x35 Em. UR-1524 3x20 95 μm
Chimneys, exhaust pipes, etc.	Em. KO-8-160	Em. KO-8-160

These materials are distinguished by accelerated drying not only at elevated (up to 80 ºC) temperatures, but also under natural conditions (3-5 hours), high decorative properties, high durability (8-10 years in temperate and cold climates and 4-5 years in tropical climate).

The use of quick-drying energy-saving materials is very important, especially in Russia. This is due to the fact that most of the agricultural machinery enterprises were built in the middle of the last century. The equipment on the painting lines has exhausted its resource and requires reengineering [3]. When reengineering paint lines, there is a simultaneous reduction in the area allocated for the paint area and an increase in the range of products to be painted.

So, for example, in JSC "Sibselmash" reengineering of paint production was carried out. For painting medium-sized parts, SPA Lakokraspokrytie proposed a two-layer energy-saving painting technology based on AU-1-201 soil-enamel and AU-1518 “Universal-Lux” enamel for medium-sized and large parts, which makes it possible to place a line of automatic and manual painting by the method spraying. Replacing the existing technology with an energy-saving one allows not only to reduce the production area for painting, but also to improve the quality and durability of the resulting paintwork. Energy-saving technology was also used in the development and implementation of a mechanized line for painting soil-cultivating equipment in Saransk (customer JV Gaspardo-RM LLC), in the development of technical proposals for the reconstruction of the painting area of Morozovskselmash OJSC (Rostov Region) and Voronezhselmash OJSC ".

However, it should be noted that the most advanced technologies for painting agricultural machinery are technologies with cataphoretic priming and powder painting. The use of these technologies will increase the competitiveness of the manufactured agricultural machinery in the world market. The equipment for the painting line of tractor cabs using cataphoretic priming followed by painting with melamine-alkyd enamels of accelerated drying was developed for the Kharkov Tractor Plant and the Automobile Plant (Elabuga).

3. CONCLUSION

The use of powder technology for painting agricultural machinery meets the requirements of environmental safety of production, can significantly reduce production areas for painting due to a single-layer application, provides a high-quality durable paintwork with high wear resistance and resistance to aggressive environments [7-10]. This technology is especially suitable for the coloring of tillage and livestock equipment, as well as equipment for the production of feed. The powder coating line was introduced by SPA Lakokraspokrytie at JSC BelAgromash-Service for painting large frame structures. A unique mobile complex of equipment for the application of powder coatings was created, allowing in tact production to paint large-sized (5350 * 800 * 2500) frame structures. All powder coating equipment, including the spray booth, is located on a movable platform that fits on rails laid in the concrete floor pit. The platform moves sequentially along the product and allows painting the product along its entire length.

Thus, SPA Lakokraspokrytie has extensive experience not only in the development of modern technologies for painting agricultural machinery, but also in the development of modern painting lines, the manufacture of complex equipment for surface preparation and painting of this technique.

At present, SPA Lakokraspokrytie is the only specialized research and production association in Russia for the development of equipment and technology for applying liquid paint and varnish materials and powder paints. SPA carries out the whole range of works related to the preparation of the surface of products for painting, design and manufacture of painting equipment, flow painting lines and their implementation in various fields of industry.

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