

Threats at Car Sprayer Job

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Abstract – A car sprayer is an important position in the modern production and car repair processes but this job is very dangerous for health of worker. Threats have been described; moreover, given were ways to protect against them and minimize the consequences of their impact.

Keywords – sprayer, safety, threats, car production, car repair.

Introduction

The preparation and painting of car bodywork is a very important stage of production and repair, because it has a huge impact on durability, the look and safety of the vehicle. This operation is not performed only at the production stage, but also during vehicle repairs and restorations. Unfortunately, due to the technologies used, it is a very harmful and dangerous process for the life and health of the painter. At the car production stage, the negative impact of the painting process is eliminated by the use of painting robots and the automation of this process. However, in paint shops which repair bodies and their components, actions are performed by the employee. Threats related to work in bodyshops are quite a serious problem, because in Poland is a great demand for their services. The reason for this is the growing number of cars in Poland i.e. about 22 mln, and a great number of collisions and road accidents in our country i.e. 32 760 road accidents and 436 469 collisions. These are data for 2017 given by the Polish National Police [2]. For this reason, quite a large number of people work in this type of workshop and is exposed to the risks associated with the exercise of this profession.

I Characteristics of the car sprayer workplace

The paint shop's workplace is factory halls or private car refinish workshops. Both of them must fulfill strictly defined ecological standards. However, it has not eliminated all health risks from work, despite the introduction of constantly improved technology. The necessary condition to ensure safe and beneficial for employees health conditions in the paint shop is adequate ventilation of the workplace. [3]

Air exchange is carried out through a natural ventilation system, which arises as a result of natural forces or forced forces, which is the result of the operation of mechanical devices introducing air into motion.[4]

In the premises of the bodyshop, both general mechanical ventilation is used, which causes the exchange of air in the whole room, as well as local ventilation, causing air exchange only in a specific space of the room. The paint shop must have free access to fire-fighting equipment.[4]

At each factory hall or in a private car refinishing company, it is also necessary to provide fire-fighting instructions and provide first aid resources. The permissible concentration of harmful substances must be observed in the spray booth. Spray booths must be equipped with self-regenerating filters.[4]

II Tasks and duties of a car sprayer

The sprayer should have basic vocational education, preferably with a car specialty. Qualifications can also be obtained through vocational training organized by vocational training institutions. The candidate for this position should be physically fit. This is required because the employee must work in an uncomfortable position, which he often has to maintain for a long time. Another important criterion is the efficiency of the respiratory system, because he resides in an environment where he is exposed to inhalation of dangerous fumes produced during work. The skill that a candidate should have for this position is primarily patience. Without this feature, it is not possible to perform the job correctly (polishing, painting, grinding). High accuracy and diligence are also required to make the end result satisfactory. [5][10]

the paint shop's employee performs such activities as preparing the vehicle for painting i.e. removing individual elements of the vehicle, cleaning of rust and dirt parts which will be varnished and protection against dirt remaining. Next the repaired element is leveled by applying sealing compounds, then it is grinded and polished to obtain a smooth surface. After the preparatory works, the lacquer coatings are applied, and then they are dried or fixed by other techniques. After painting, the employee must reassemble the car. [11]

III Threats at car sprayer job

At each stage of the work, the car sprayer is subjected to the harmful effects of by-products formed during the entire painting process. It is for example: chemical and toxic substances contained in varnishes, primers, solvents and other chemical agents used during the work. Dust and metal particles created during grinding and surface leveling. Appropriate temperature prevailing in the paint chamber, as well as special light required for a good distinction of colors of varnish affect the employee's well-being and physical fatigue. Another aspect is working in forced positions, which causes fatigue and may in the long run cause degeneration of the motor system.[9]

In paint shops, individual stages of work on the body are carried out in different rooms due to the specificity of the preparation and painting process, so the vehicle is transferred between the phases of the process. This action may involve the risk of hitting an employee. In order to prevent this type of events, tables, warning signs and proper layout of workplaces are used.[6]

Substances used to paint bodies are usually flammable. For this reason, in the paint chambers and other areas of the paint shop there is a risk of explosion of chemical fumes and then a fire. In order to reduce the probability of such a phenomenon, ventilation systems are used, as well as employees are properly trained and acquainted with basic safety principles such as the prohibition of using open fire. In the event of a fire, extinguishing agents are located on the premises, for example: fire extinguishers, fire blankets, etc.. Paintshops can be additionally equipped with smoke and sprinkler systems.[6]

The specificity of the refinisher's work means that substances used in technological processes are prepared on a regular basis from substances that are components of the agent used during painting works. Incorrect posture when lifting and moving heavy loads causes various injuries of the musculoskeletal system, such as: disc prolapse, tendon rupture, hernia formation, etc. In order to prevent such threats, the workplace is designed in such a way that the worker is not forced to carry heavy objects for long distances, as well as to lift at high altitudes.[1]

The car sprayer during preparation of the body and during its painting is often forced to work in a forced, unnatural position of the body, which causes increased fatigue, as well as pain in particular parts of the body, including: back, arms and legs. Physical discomfort also affects the feeling of mental fatigue, increased frustration, which results in a deterioration of the quality and

efficiency of the work performed. In order to improve the comfort of work, the station should be designed in such a way that it does not force unnatural position during work. Diversification of elements and their location in the vehicle requires the possibility of adjusting the work station in such a way as to facilitate the activities performed by the employee.[1]

Chemical threats

During works performed by the paint shop employee, various chemical agents are used, such as varnishes, primers, solvents. They are extremely dangerous for the health and life of the person exposed to their effects. Such factors can be divided due to the way they affect the human body, i.e.: toxic, irritant, sensitizing, carcinogenic and mutagenic. The most harmful substances get into the body through the fumes that are inhaled with the air by the worker and further through the respiratory tract and circulatory system are distributed throughout the body.[6]

Toxic factors are in a lots of varnishes. One of the components found in the varnishes is the isocyanate hardener. Prolonged contact with it causes severe and incurable asthma. Another substance contained in varnishes is benzene. It causes headaches and dizziness, general weakness, nausea and vomiting. With high exposure to benzene, visual disturbances, rapid and shallow breathing, tremor of the extremities, arrhythmia, paralysis and coma occur. Exposure to benzene in the long term may result in bone marrow aplasia. Chronic Benzene poisoning results in death after severe marrow aplasia, anemia, necrosis or fat degeneration of the myocardium, liver and adrenal glands. The next chemical is xylene. Xylene pairs are irritating to mucous membranes of the respiratory system. They cause headaches, dizziness, nausea and vomiting. In large quantities, it causes arrhythmias with the risk of ventricular fibrillation, loss of consciousness and death. Xylene in liquid form has an irritating effect, irritates the conjunctiva and causes redness. In chronic poisoning, nervous system disorders, long-term conjunctivitis.[6]

On the impact of irritants the car sprayer is exposed during preparatory work before painting. Particularly when degreasing the surface. For this purpose, various solvents are used which, in contact with the skin, cause it to dry, crack, peel and irritate. In the long term, they can cause burning wounds difficult to treat. Solvent pairs act on the neurological system. There are nausea, dizziness and headaches, as well as general weakness. Conjunctivitis may also appear.[6]

Some varnishes may contain isocyanates and resins that may cause sensitization. Inhaling the pairs of these substances is usually the cause of allergies and asthma. Carcinogenic and mutagenic substances contained in varnishes and solvents are benzene. This substance is associated with liver proteins, bone marrow, kidney, spleen, blood and muscle proteins, causing, among others, leukemia.[6]

In order to prevent the harmful effects of chemical agents and other threats described above, individual protective measures such as masks, gloves, goggles, aprons, paint suits and safety shoes are used (Fig. 1). Varnishing should take place in special paint chambers, where adequate ventilation is ensured.[6]

Physical threats

Slips, trips and falls are among the most common causes of accidents among employees. The risk of falling is most likely when moving on slippery or uneven surfaces. The most frequently mentioned are two types of falls: falls due to tripping, falls due to slipping. The stumble is related to the distance between the ground and the foot surface during the step phase, while the slip phenomenon is defined as a sudden loss of adhesion, leading to the slippage of the foot on the ground. This is caused by a smaller value of the coefficient of friction than is required. The formation of slips and trips is associated primarily with the quality of the substrate, but also with human factors such as age, weight, mobility and visual fitness.[6]



Fig.1. Personal protective equipment

1-mask, 2-glasses, 3-gloves, 4-overalls, 5-protective footwear

A major threat to the health of car painters in the bodyshop is the high noise level resulting from the need to use pneumatic systems with compressors, blowers and fans used in the booth equipment. People who are under the influence of noise for a long time are exposed to frequent headaches and fatigue.[6]

Lighting of workshop rooms is one of the most important factors affecting work efficiency. Natural lighting is definitely more beneficial than assisted lighting, which must be artificial (electric) lighting. Properly selected light color and hue causes less fatigue in the eyes, which is of great importance when choosing appropriate shades of car paints.[6]

When using shortwave infrared radiators for drying paint coatings, the maximum permissible irradiation of eyes and skin should be respected. Radiation can cause an increase in skin temperature and, consequently, burns. Very often, as a criterion of risk, thermal damage to the skin and conjunctiva, lens and retina is prevented.[6]

Static electricity and the phenomenon of electrification are the basis of the coating production process in powder coating plants. The causes of the formation and accumulation of electrostatic charges as well as improper methods of paint shop operation cause that static electricity is also a threat factor.[6]

There is a high risk of fire or electric shock in the premises of the painting facility. The influence of electric current on the human body can be direct when an electric current passes through its body, or indirect, causing various thermal or mechanical injuries arising without the flow of current through the body. Direct action causes many physical, chemical and biological changes in the body, disrupts the nervous system, so it can cause muscle cramps, stop breathing, blood circulation disorders, sight, hearing and balance disorders, or loss of consciousness. Electric shock may occur after human body contact with metal parts that are not normally energized, i.e. they are separated from the electrical circuit by insulation.

Danger of electric shock exists in all electrical devices where the operating voltages exceed the values of safe voltages (Table 1).[7]

Table 1.

Safety voltage		
Environmental conditions	Amplitude current [V]	Direct current [V]
normalne	50	120
szczególne	25	60

The indirect action of an electric current causes various types of injuries that arise without the flow of current through the body. One of the indirect effects of electricity on a man is an electric arc burn or damage to the eyes due to the high brightness of the electric arc. [7]

During the preparation work before painting a lot of dust is created, especially when sanding the body and sanding the surface on which additional material was applied in order to compensate for unevenness. The particles of the ground material and the abrasive get into the respiratory system causing in the long term pneumoconiosis. The visual system is also exposed because dust and debris can cause irritation and mechanical eye damage.[8]

IV Proposals of corrective actions for identified threats.

In order to prevent threats and the impact of harmful factors in the workplace of a car varnish, prophylactic and corrective actions should be used. To minimize the risk of explosion and fire, do not smoke in the paint booth as well as in the vicinity of flammable substances, use open fire and use electric heat sources. Any fault and malfunction of the ventilation system should be reported to the supervisor and repaired as soon as possible. Technical inspections of paint chambers and other devices should be carried out systematically, and also follow the attached technical and operational documentation for individual machines and devices. The measurement of harmful factors should be performed systematically, mainly noise, vibrations, dust, as well as chemical factors. In order to prevent accidents with chemical substances, all packaging with chemical substances must have appropriate and clearly visible markings. Another way to reduce the risks is to put paints and varnishes containing less harmful substances into use. The employee must be aware of the risks to which he is exposed during work, therefore he should be properly trained in the field of occupational health and safety and must have permanent access to the material characteristics sheets used at his workplace. He must be equipped with personal protective equipment, but also trained how to properly use it and how important it is for his health and life.[1]

Conclusion

There are many threats in the work of a car painter that are dangerous to the employee's life and health. Some of the most common threats include overloads of the musculoskeletal system, forced, static body position and industrial dust. In contrast, chemical hazards cause the most serious effects on workers' health and life. Actions aimed at limiting their impact are very important due to the large number of people working in such facilities.

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