

# SETTING UP THE MAINTENANCE OF GROUND SUPPORT EQUIPMENT MANAGEMENT PROCESS

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**Abstract:** *At the airport, the emphasis is on safety, smooth operation and maintenance of technical equipment and technical means for ground handling aircraft. Therefore, the main objective of the paper is setting up the maintenance of ground support equipment management process. Every type of ground support equipment has its own maintenance. The result of this paper are suggestions to maintenance of selected ground support equipment and the airport sweeper, tractor and mulcher.*

**Key Words:** *Airport sweeper; Ground support equipment maintenance; Mulcher; Safety; Tractor*

## 1 INTRODUCTION

Air transport and aircraft constitute a specific category of services, which are characterized by a high level of operational safety in comparison to other modes of transport and means of transport. Much emphasis is placed on safety and continuity of service. Ground support equipment ensures fluidity of air transport. If the aerodrome operating technique delivers on its operational phase required technical effects, undeniably it requires appropriate maintenance. The work outlines the basic maintenance division and its impact on the function and performance to the individual type of service at the airport. Maintenance is a combination of all technical, administrative and managerial actions during the life cycle of ground support equipment. Maintenance is intended to maintain the state or return to a state in which the apparatus can perform a required function.

In this paper we consider a general user maintenance ground support equipment because of the prevalence of this technique. With the ground support equipment, maintenance is chosen primarily with respect to functional and financial burdens that arise from individual maintenance steps at the airport. On machines where maximum emphasis is placed on the reliability of the reasons irreplaceableness or safety risk analysis is carried out and on the basis of diagnostic and maintenance activities. The aim of this paper is the summation of maintaining the ground support equipment and determine the importance of each step, given the cause of the fault.

In conclusion maintenance of selected ground support equipment is proposed. Based on the acquired maintenance theory we proposed the maintenance of airport sweeper, tractor and mulcher. These machines are among the main types of ground support equipment. Serve to ensure safety of operations at the airport movement area.

## 2 MAINTENANCE OF MACHINERY

With maintenance of the airport as a primary goal it is very to prevent or mitigate a failure of airport equipment. The best way is to prevent equipment failure at the airport to prevent disorder rather than let it actually occurs. Failure could be prevented in order to protect or restore equipment reliability by replacing worn components before they actually fail or malfunction. This is important in service preventive maintenance.

### 2.1 Types of the maintenance

With the development of airports also new equipment and machines were implemented as well as maintenance requirements, according to which functions of the devices had to be restored as

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quickly as possible. Therefore new types of maintenance had to be developed to ensure better operation of the system at the airport. There are two basic types of maintenance:

- preventive maintenance,
- corrective and reactive maintenance (maintenance after failure).

Preventive maintenance is performed at regular time intervals. These intervals are determined in advance, to avoid a possible malfunction or failure, and deterioration of the functioning of the system or machine at the airport. Preventive maintenance is conducted in a manner such as replacing old and worn-out parts of their greasing or cleaning. These activities are planned in this case by the maintenance or operations management unit of airports or by other centres that are competent. Preventive maintenance based on technical condition of the device is based on the monitoring of features, characteristics and parameters of the equipment at the airport. Monitoring of these functions is either planned or they are continuously monitored. Human senses of sight, hearing, touch and smell are not sufficient anymore. Technological progress allows us to better monitor the system and its physical properties and the sensors and transmitters, which is more efficient and secure. Thus the monitoring and evaluation devices and diagnostic equipment are becoming more and more sophisticated.

Failure of equipment as a problem is considered in the standard EN 133306, which talks about the ability of the building or equipment to perform the desired function. Arguments in the standard bring maintenance management and airport operations to strive for maximum availability and also to attempt to reduce the number of failures and repairs.

Corrective (reactive) maintenance is maintenance, which aims in the case of equipment failure and machinery to repair the given disorder as soon as possible. Its mission is to bring equipment from the failed state back into operation, modify or replace faulty components of the machine at the airport. This maintenance is unplanned and is done in case of equipment failure. The maintenance is divided thereafter to immediate and deferred maintenance. Immediate maintenance is performed just after detection of faults. As stated by Červeňan, 2015, deferred maintenance means the maintenance actions are postponed because of a lack of spare parts or in case of malfunction ignorance.

## **2.2 Maintenance model**

Maintenance is a specialized activity, it aims to improve the technical side of the device, to improve or maintain the original features of airport facilities. Maintenance is used to increase the time and power utilization of machinery and equipment at the airport. For maintenance, it is important to take into account the health and safety of operation and environmental protection.

Maintenance management is not just a way of troubleshooting and prevention but it is a process where you need to manage all administrative and technical activities of airport facilities throughout its life-cycle. The aim of maintenance management is to restore the status of the device so that it can continuously perform his duties at the airport, taking into account the least possible cost and optimal requirements for quality and safety of manufactured products.

Maintenance management can be understood as a management system or as an integrated maintenance management. Integrated management of maintenance and maintenance management is the management of all management actions that determine the objectives, strategies and responsibilities of maintenance. The maintenance management model can be applied on the process approach model of maintenance management. The maintenance management model is designed by the American professor Walter E. Deming, who created the Deming Cycle P-D-C-A. Deming Cycle is a systematic approach to problem solving and means Plan, Do, Check, Act. Deming Cycle is the basis for continuous improvement. It's a philosophy that leads the management of maintenance management to stabilizing and improving the maintenance process. It's a vicious circle. PDCA cycle is used as a universal model, which has a major impact on quality improvement. PDCA cycle has four steps in which it is necessary that manager thought and acted quickly and efficiently.

We distinguish 6 maintenance processes:

- maintenance management,
- maintenance planning,
- preparation of maintenance,
- implementation of maintenance,
- assessment of maintenance,

- improved maintenance.

### **3 MAINTENANCE OF SELECTED GROUND SUPPORT EQUIPMENT**

Modern diagnostic equipment includes a large range of specialized products and is operated by personnel with high expertise and knowledge about maintenance to carry out the maintenance and repair of ground support equipment on the highest level. This chapter prepared proposals for selected operating maintenance of ground support equipment. At the airport there is a large number of different ground support equipment. In this chapter, we first suggested and breakdown maintenance of airport sweeper. Airport sweeper is one of the major ground support equipment machinery. Its role and the main objective is to ensure safety and smooth traffic at the airport. Airport sweeper ensures purity at the movement areas at the airport such as the runways, taxiways and apron. Another machine from the maintenance ground support equipment which we have elaborated in this chapter is the tractor and its maintenance. The tractor is also one of the main facilities of the ground support equipment. Tractor is a versatile machine that allows to connect several types of devices, such as a mower, mulcher, snow plow etc. It ensures operational safety and aircraft movements on the airport. It can be used for the summer maintenance of the airport as well as for the winter maintenance. The last but not least equipment that is mentioned in this chapter is mulcher, which can be attached to a tractor and is used for mowing grass areas at the airport.

#### ***3.1 Airport sweeper***

Sweeper maintenance program is based on an assessment of the design units, from the evaluation of the admissibility of fatigue and damage of the test results and the experience of other sweeper operations. The maintenance program has to establish which parts of the sweeper must be kept stored, what goals are to be achieved by the maintenance, the resources used and in what intervals has the maintenance to be carried out. These questions form a complicated complex, the solution of which can be divided into the following sub-tasks:

- Regular preventive maintenance of the airport sweeper,
- Maintenance of the airport sweeper after failure.

##### ***3.1.1 Regular preventive maintenance of the airport sweeper***

Effective maintenance program includes only those tasks that are necessary to meet the objectives. Therefore it does not contain redundant tasks to increase the maintenance costs. Preventive periodic maintenance of the sweeper can still be divided according to time for technical maintenance and seasonal maintenance.

Technical maintenance on airport sweepers means the consideration of following sub-systems:

- airport sweeper brake system,
- airport sweeper control,
- axles, wheels, suspension, shafts and joints of the airport sweeper,
- frame and body of the airport sweeper,
- headlight and signalling (lights, beacons),
- prescribed and special equipment (control of cleaning brushes, container, detergent, water and detergent),
- other systems, components or separate technical units (control magnet, rotary brushes, snow plow),
- environmental burden,
- vehicle's identifiers with the details given in the vehicle documents.

##### ***3.1.2 Seasonal maintenance of the airport sweeper***

In seasonal maintenance, airport sweeper diagnostics is carried out and the items checked include:

- engine power and engine highest speed performance,
- fuel consumption at standard modes,
- idling speed,
- airport sweeper ignition setting and recharging system,
- amount of pollutant in the exhaust gas - emission control,
- wheel alignment,

- achieved speed and acceleration, the effectiveness of the braking system,
- operation of safety features and equipment,
- noise,
- setting headlight,
- other special equipment airport sweeper.

### 3.1.3 Maintenance of the airport sweeper after failure

Maintenance of the sweeper after failure is a special maintenance. Maintenance is carried out only at the moment of sweeper's failure. Time to failure element is a random variable, failure comes unexpectedly. The faulty element must not compromise safety and the environment, should not cause immediate inability to operate the sweeper or induce damage to other elements of the sweeper. Defective portion of the sweeper should be easily replaceable to reduce maintenance downtime period. Maintaining the sweeper after its failure is most often done by a certified service provider, which in many cases is the sweeper manufacturer. Maintaining the airport sweeper after failure is depicted in Figure 1. Five major steps are included:

1. step is finding the fault on the airport sweeper,
2. step is fault analysis on the airport sweeper,
3. step is to plan bug fixes and maintenance of the airport sweeper,
4. step is subsequent implementation of planned bug fixes and maintenance of airport sweeper,
5. step and last step is to optimize the airport sweeper.

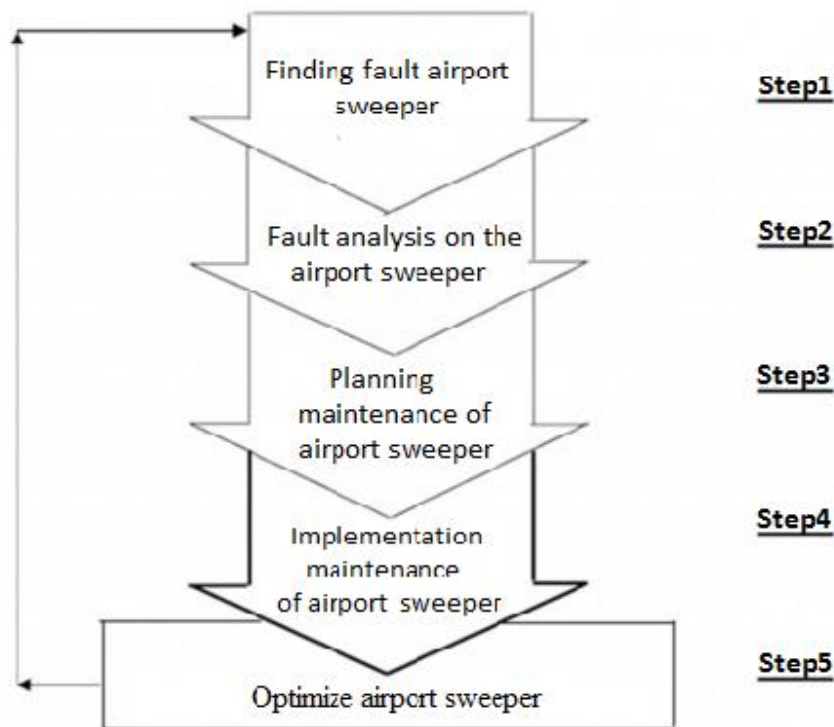


Figure 1 Draft procedure for maintaining the airport sweeper after failure

### 3.2 Maintenance of the tractor

The use of these machines is suitable for small airports as well as for large airports. They may be used in the summer and winter maintenance of the airport and also to tow aircraft to or from the stands. Tractors can be equipped with the front-mounted plow and mower, which is beyond its year-long deployment significantly enlarged. Perfect alignment of engine, transmission and hydraulic system allows the tractors at the airport excellent handling, drag and manoeuvrability.

The basic daily maintenance of the tractor includes:

- Check the oil - for tractors, we should check the oil level after each ride whether the scale shows a sufficient amount of oil. If not, it is necessary to add oil. Also important is to always use oil recommended by the manufacturer of the tractor.

- Check the coolant - heaters are designed to heat the coolant in the tractor engine. It serves to facilitate starting in winter when temperatures drop below -10 ° C. The coolant should be regularly topped up.
- Checking the brake - brakes are an essential part of the tractor which have to be really carefully checked. Periodically, we should change the brake pads and check how well they work.
- Checking the tires - tires should be checked before each ride. It is important to check the overall condition of the tires, any cracks or insufficiencies in the tire tread. While executing the control we should also assure all nuts and bolts are properly tightened. Where the nuts or bolts are loose, it is necessary to tighten them. If the tires have large cracks or are very worn, they must be promptly replaced. The tractor tires suffer mostly in winter.
- Controlling lights - check that all the lights on our tractor really light up. The lights are another important part of the tractor, which should be constantly working.
- Checking fuel - before each ride check whether the tractor has enough fuel. We should always use the fuel recommended by the manufacturer.
- Checking attachments - special caution should be exercised when using additional equipment. Spray tanks, plow, mower, crusher and other equipment can change the centre of gravity and stability. We are making sure in particular that all peripheral devices are designed for our type of tractor.

Maintenance of tractors after failure is carried out after the detection of a malfunction. The main objective is to repair faults of the tractor as soon as possible. The main task is to return the tractor back in service the airport, so as not to endanger the safety of traffic at the airport. After finding fault the condition of the tractor is evaluated. If the given disorders are fixed the tractor remains at the airport. Most often the fault of the tractor is repaired by replaced the faulty element by new parts of the tractor. Where the fault can not be corrected, the tractor is moved, pulled or taken to a certified service centre.

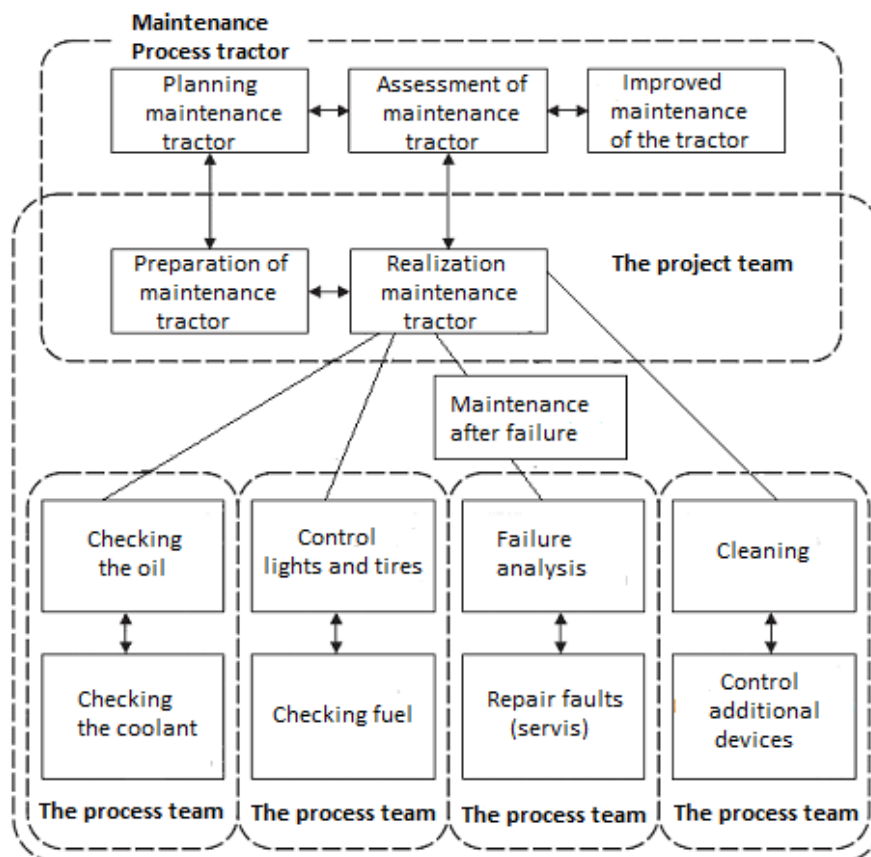


Figure 2 Proposal of the tractor maintenance organizational structure at the airport

In the Figure 2 is a draft of the tractor maintenance organizational structure at the airport. Maintenance process is divided along the lines of Deming Cycle to design the maintenance of the tractor, the tractor maintenance training, maintenance implementation and evaluation of maintenance or improvement of maintenance. Implementation of maintenance of the tractor at the airport can be carried out on the basis of preventive maintenance, or maintenance after the failure of the tractor. The role of preventive maintenance is to keep the tractor in continuous operation and there are activities that are made either in the daily or technical maintenance of the tractor. For maintenance of tractors after failure the failure analysis is carried out and possibly the tractor is towed to service or repair station. While carrying out these works one must abide the rules and the safety of airport operations.

### **3.3 Maintenance of the mulcher**

At the airport it is required to mow large lawns, therefore the most commonly used are lateral or side mower. The airport mowing or mulching has to be done at least twice a year, generally at the end of May and August and that when grass height reaches 40-50 cm.

Mulcher must be regularly inspected for any visible traces of wear and tear. Preventive maintenance of the mulcher involves several activities. Special attention is given the hammer and their connections and V-belts. If some parts show any damage or excessive wear, it should be replaced immediately. Otherwise the parts may break away and cause damage or injury. In carrying out any cleaning or maintenance the engine must be turned off. During the regular maintenance of the mulcher nuts and bolts are checked, whether they are properly tightened. If not, they should be tightened. With regular preventive maintenance the status of oil and gears and filters is checked. In case of finding lack of oil in the tank or oil wear you need to replace the oil. When checking the electrical system one must always be isolated to avoid electric shock. During the preventive maintenance the tension belts should be checked, as they controls the security and functionality of individual elements of the mulcher. After all the work the machine is cleaned and visual inspection is being performed. If there is a subsequent wash of the grease, it is necessary to lubricate the machine once again and possibly lubricate the bearings. They are checked with a hammer to fit.

In the event of a fault the disorder is controlled and catered to. Failure is evaluated and the repair is planned. In the event that maintenance workers can not fix the error the mulcher and shredder is taken to the service.

## **4 CONCLUSION**

Maintenance of ground support equipment is an important part of the airport. For the successful maintenance program it is necessary to create uniform procedures designed to improve the performance and safety of ground support equipment. In addition, maintenance helps to improve equipment life and to avoid any unforeseen disturbances of aerodrome operating techniques. Successful maintenance program is dependent on the cooperation of all stakeholders and the maintenance and operation of the airport.

When performing maintenance, it is very important to ensure safety at work and observe the safety rules. Each airport must have a plan of maintenance. Each type of ground support equipment requires regular preventive maintenance. Maintenance should be performed after malfunctioning of the equipment at the airport, when it is assessed whether it is possible to repair the fault at the airport or it is necessary to bring the machine to service. Anyhow, maintenance must not endanger air safety.

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