SLOVENSKI STANDARD
SIST EN 17023:2019

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Železniške naprave - Vzdrževanje voznega parka - Oblikovanje in sprememba načrta vzdrževanja

Railway applications - Rolling stock maintenance - Creation and modification of maintenance plan

Bahnanwendungen - Schienenfahrzeuginstandhaltung - Erstellung und Änderung von Instandhaltungsplänen

Applications ferroviaires - Maintenance du matériel roulant - Création et modification du plan de maintenance

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Railway applications - Railway vehicle maintenance - Creation and modification of maintenance plan

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Bahnanwendungen - Instandhaltung von Eisenbahnfahrzeugen - Erstellung und Änderung von Instandhaltungsplänen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 17023:2018) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

In the field of railway maintenance, the purpose of this document is to define key processes to create and modify the maintenance plan for railway vehicles.

Each railway vehicle has to be in a safe state of running and achieve performance targets when in service. This is achieved by operating the vehicle under defined conditions, and performing a maintenance system, including corrective and preventive maintenance on certain components/functions at certain periodicities at a maintenance facility.

The maintenance plan is a part of the maintenance system, contains the descriptions of the activities, quality criteria, procedures and intervals to be undertaken during scheduled maintenance with the objective to ensure the vehicle complies with the target condition.

The construction of new vehicles is accompanied by an appropriate set of technical, maintenance and operating documents to support the vehicles along their life cycle.

1 Scope

This document describes the methodology and the elements to be considered for the creation and modification of a vehicle maintenance plan, up to the validation. This document describes general requirements (list of input data, structure and content) of a maintenance plan.

For the creation and modification of a maintenance plan, this document lists:

- preparation and selection of documents and input data;
- analysis of input data and development of the maintenance plan up to its validation;
- process to be followed to create a maintenance plan;
- reasons to check a current maintenance plan;
- risk assessment and process to be followed to modify the maintenance plan;
- monitoring conditions (e.g. justification methods, verification, validation, documentation, roles, skills and knowledge).

This document applies only to preventive maintenance.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 17018, *Railway applications — Rolling stock maintenance — Terms and definitions*

EN 31010, *Risk management — Risk assessment techniques (IEC/ISO 31010)*

EN 50126 (all parts), *Railway Applications — The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)*

EN 50128, *Railway applications — Communication, signalling and processing systems — Software for railway control and protection systems*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions given in EN 17018 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Symbols and abbreviations

For the purposes of this document, the abbreviations given in Table 1 apply.

Table 1 — Abbreviations

Abbreviation	Designation
CSM RA	Common Safety Method in Risk Evaluation and Assessment
EUAR	European Union Agency for Railways
FMECA	Failure Mode, Effects and Criticality Analysis
LCC	Life Cycle Costs
MP	Maintenance Plan
NIB	National Investigation Body
NSA	National Safety Authority
OEM	Original Equipment Manufacturer
RAMS	Reliability, availability, maintainability and safety
REX	Return of Experience
TSI	Technical Specification for Interoperability

4 General requirements for maintenance plans

4.1 Introduction

Vehicles shall be in a safe state of running by means of a maintenance system. Part of this maintenance system is the maintenance plan which contains the description of activities and procedures to be undertaken during scheduled maintenance with the objective of ensuring that the vehicle complies with the target condition.

Initially, all the information relevant for maintenance is collected, and a maintenance plan for testing and commissioning stages is prepared to ensure the vehicle is in a safe state of running and in good order when released for the beginning of the operation. This testing and commissioning maintenance plan may not cover a part of the components/functions relevant for maintenance (e.g. interior fittings).

However, a complete maintenance plan is prepared and applied from the beginning of the service operation of the railway vehicle and during the lifetime.

The ongoing suitability of the maintenance plan should be checked and over time the maintenance plan can be changed to reflect how components wear or the service usage of the vehicle changes.

Maintenance plans shall be created according to Clause 5 and modified according to Clause 6.

4.2 Input data

For the creation or modification of a maintenance plan, all relevant and available input data shall be considered, as follows:

a) legislation, regulations and standards:

- national and European legislation where applicable, depending on the operational area of use;
- national and European standards which apply for the operational area of use;

b) technical documentation:

- current and target configuration of the vehicle;

- technical drawings and descriptions;
- bill of materials;
- electrical, pneumatic, hydraulic diagrams, etc.;
- maintenance file and technical documentation from the vehicle manufacturer;
- maintenance file and technical documentation from the OEM;
- control measures derived from risk assessment (including safety);
- existing maintenance manuals from comparable railway vehicles;
- software documentation;
- any other requirements coming from the authorization process;

c) performance targets:

- planned operational conditions (e.g. annual mileage and operating time, usage of the vehicle, geographical area of use, climatic conditions);
- functional requirements for the vehicle target condition (e.g function of redundant subsystems);
- comfort requirements for the vehicle target condition (e.g. cleaning, function of toilets);
- organisational requirements on maintenance concept (e.g. balanced maintenance, periodic maintenance, condition based maintenance, predictive maintenance);
- reliability, availability, environmental and cost targets, e.g. LCC;
- estimation of residual value or residual life considerations;
- other customer specific requirements;

d) information on operation:

- current operational conditions (e.g. annual mileage and operating time, number of station stops, geographical area of use, climatic conditions);
- incidents and safety relevant occurrences involving vehicles already in service or operating in similar conditions;

e) return of experience on maintenance:

- established and proven maintenance plans of existing reference vehicles and components;
- maintenance records on preventive and corrective maintenance performed;
- data analysis of previous maintenance activities and failures;

f) technological survey:

— safety reports from National Safety Authorities involving vehicles already in service or operating in similar conditions;

— reports from the National Investigation Bodies;

— other public domain documents and reports for safety development (e.g. academic research);

— data or results from durability, life and stress analyses;

— new methods and tools of maintenance (for example, predictive maintenance tools).

4.3 Structure of a maintenance plan

A maintenance plan shall be composed of a structured list of all maintenance activities to be carried out on a scheduled basis as well as their maintenance interval limits.

Depending on the requirements, a maintenance plan might be defined for the entire vehicle or separately for selected components. All relevant parts of the vehicle shall be covered by a maintenance plan.

4.4 Content of a maintenance plan

The minimum content of a maintenance plan shall be:

— title, unique identification number, issue and/or revision number, and date;

— approval and authorization by appropriate persons;

— overview of the main changes from previous version;

— table of contents;

— scope of application (e.g. component, vehicle, type, operating conditions);

— list of maintenance activities and their maintenance interval limit values;

— required information related to each maintenance activity.

The list of maintenance activities can be represented as a periodicity table or step frequency table.

NOTE For further information, see Annex C.

4.5 Periodicity table

When a periodicity table is used, it shall contain an overview of the planned maintenance activities to be carried out.

Maintenance activities can be grouped into maintenance steps or remain as separate activities with determined intervals.

Maintenance activities shall contain a description of maintenance tasks, the quality criteria to be reached, and maintenance limit values.

The periodicity table can refer to other documents to define the activity, work instructions, measurement sheets to be completed, etc.

Maintenance limit values shall be defined based on the expected wear (which usually depends on the usage of the vehicle), the service limit values and the target condition.

Examples of periodicity tables are shown in Annex D.

4.6 Maintenance interval limit and step frequency table

The maintenance interval limit between steps or separate maintenance activities shall be defined based at least on wear and ageing of the vehicle components. The maintenance interval limit for each maintenance activity or step shall be defined in the way that the target condition is respected and defined service limit values are not exceeded.

The maintenance interval limit shall be composed of a suitable unit. This unit can be for example time, kilometres, ton kilometres or number of cycles. The unit shall depend on the condition of the considered vehicle or component.

The maintenance interval limit shall be a maximum and shall not be exceeded.

A step frequency table shall contain the maintenance steps sequence and its maintenance interval limits.

This table can be represented also in a graphical view.

Examples of step frequency table are shown in Annex D.

For operational or commercial reasons, the maintenance interval limit may be shortened and a planning value including tolerances may be defined.

5 Creation of a maintenance plan

The creation of a maintenance plan shall consider the following steps:

a) preparation and selection of input:

- assign specialists and responsibilities according to Clause 8;
- define the system to be considered (e.g. vehicle, function, component, interfaces and exclusions);
- identify, collect and select relevant input data as outlined in 4.2;
- identify components with relevance for maintenance;
- identify components with relevance for safety; see Annex B;

b) development of maintenance plan and risk assessment:

- define maintenance concept (e.g. balanced/modular, condition based or predictive maintenance);
- identify maintenance activities and respective maintenance interval limits for relevant components, applying risk assessment methods, analysing and evaluating both equipment supplier's maintenance requirements (based on OEM documentation) and vehicle manufacturer’s maintenance requirements, respecting performance targets;
- compile the list of maintenance activities for the railway vehicle;
- assign maintenance interval limits to maintenance activities;
- group maintenance activities into steps if required, and determine step frequency table with maintenance interval limits and sequence (e.g. in table form/graphic representation);

— document the conversion method of maintenance units and assumptions used (e.g. conversion of engine hours into vehicle mileage), adjust maintenance intervals if required;

— compile the initial maintenance plan, preparing step frequency table and periodicity table;

c) verification, validation and documentation of the maintenance plan, compilation of justification file as outlined in Clause 7.

Methods and techniques to analyse data and make decisions along the process are referenced in EN 31010, the EN 50126 series and EN 50128 (see also Annex A and Annex B).

NOTE Service experience after warranty is valuable for manufacturers for improvement of future maintenance plans.

6 Modification of maintenance plan

6.1 General

A maintenance plan shall be in line with the stated usage (operating profile) and the performance targets. Nevertheless, there can be further reasons to modify the current maintenance plan:

a) change of input data, basis of current maintenance plan (e.g.: change of reference or linked document, change of operational profile, technical modification or modification of the target configuration of the vehicle, refurbishment/renewal of the vehicle, change of the concept of maintenance, innovative methods ...) as described in 4.2;

b) return of experience from:

— operation (e.g. change of use, driver or train crew feedback relevant for maintenance, incidents, etc.);

— maintenance (e.g. repetitive faults, data analysis task and failure, etc.);

c) safety relevant events;

d) NSA or NIB recommendations.

If a modification of the maintenance plan is needed, the process follows as in 6.2.

In case of editorial changes (e.g. textual errors) or it is judged to be trivial the following process is not required.

6.2 Project work flow

6.2.1 Project steps

Starting from the reasons addressing the proposed change, the following steps as outlined in this clause and on Figure 1 shall be followed.

The responsibilities of the persons modifying the maintenance plan shall be assigned as outlined in Clause 8.

NOTE This section explains how to apply the methods set out in Regulation (EU) 402/2013 in case of maintenance plan modification.