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Maintenance - Maintenance Key Performance Indicators

Instandhaltung - Wesentliche Leistungskennzahlen für die Instandhaltung

Maintenance - Indicateurs-clés de performances en matière de maintenance

Ta slovenski standard je istoveten z: **EN 15341:2007**

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**ICS:**

03.100.99	Drugi standardi v zvezi z organizacijo in vodenjem podjetja	Other standards related to company organization and management
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ICS 03.100.99

English Version

## Maintenance - Maintenance Key Performance Indicators

Maintenance - Indicateurs-clés de performances en matière  
de maintenance

Instandhaltung - Wesentliche Leistungskennzahlen für die  
Instandhaltung

This European Standard was approved by CEN on 10 February 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document (EN 15341:2007) has been prepared by Technical Committee CEN/TC 319 "Maintenance", the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by September 2007, and conflicting national standards shall be withdrawn at the latest by September 2007.

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

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## Introduction

This European Standard provides Maintenance Key Performance Indicators to support management in achieving maintenance excellence and utilize technical assets in a competitive manner. The majority of these indicators apply to all industrial and supporting facilities (buildings, infrastructure, transport, distribution, networks, etc). These indicators should be used to:

- a) measure the status;
- b) compare (internal and external benchmarks);
- c) diagnose (analysis of strengths and weaknesses);
- d) identify objectives and define targets to be reached;
- e) plan improvement actions;
- f) continuously measure changes over time.

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## 1 Scope

This European standard describes a system for managing Key Performance Indicators to measure maintenance performance in the framework of the influencing factors such as economical, technical and organisational aspects, to appraise and to improve efficiency and effectiveness to achieve excellence in maintaining Technical Assets.

## 2 Normative references

The following referenced documents are indispensable for the application 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 13306:2001, *Maintenance Terminology*

IEC 60050-191:1990 *International electrotechnical vocabulary; chapter 191: dependability and quality of service*

## 3 Terms and definitions

For the purposes of this document the terms and definitions given in EN 13306:2001, IEC 60050-191:1990 and Annex A of this document, together with the following apply.

### 3.1 indicator

measured characteristic (or a set of characteristics) of a phenomenon, according to a given formula, which assess the evolution

NOTE Indicators are related to objectives.

### 3.2 scorecard

set of associated, consistent and complementary indicators providing synthetic and global information

NOTE It is a tool for the development and implementation of a strategy and for monitoring progress towards the goals outlined in the strategy.

## 4 Maintenance Performance

Maintenance Performance is the result of actively using resources to retain an item, or restore it to a state in which it can perform its required function. It can be expressed as an achieved or expected result.

Maintenance Performance depends on both external and internal factors such as: location, culture, transformation and service processes, size, utilization rate and age and is achieved by implementing corrective, preventive and improvement maintenance, using labour, information, materials, organisational methodologies, tools and operating techniques.

Maintenance Performance is an outcome of complex activities which can be evaluated by appropriate indicators to measure both the actual and expected results.

## 5 System of indicators

### 5.1 General

To cover this aspect of maintenance, this system of key performance indicators is structured into three groups: economic, technical and organisational.

These proposed indicators can be evaluated as a ratio between factors (numerator and denominator) measuring activities, resources or events, according to a given formula.

These indicators are used to measure any quantitative aspect or characteristic of an indenture level and homogeneous comparison.

Whenever a factor is defined using the words "internal" or "external", the derived indicator, should also be used only for "internal" or "external" influences.

### 5.2 Objectives

When the actual or expected performance is not satisfactory, it encourages management to define objectives and strategies to improve from an economic, technical or organisational point of view using the following system of indicators, allowing the organisation to:

- a) measure the status;
- b) evaluate the performance;
- c) compare performance;
- d) identify strengths and weaknesses;
- e) control progress and changes over time.

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Measurement and analysis of these indicators can help management to:

- f) set objectives;
- g) plan strategies and actions;
- h) share the results in order to inform and motivate people.

These indicators can be used:

- i) on a periodic basis, for instance by preparing and following-up a budget, and during performance assessment;
- j) on a spot basis, for instance within the framework of specific audits, studies and/or benchmarking.

The period of time to be considered for measurement depends on the company policy and management approach.

### 5.3 Architecture of key indicators

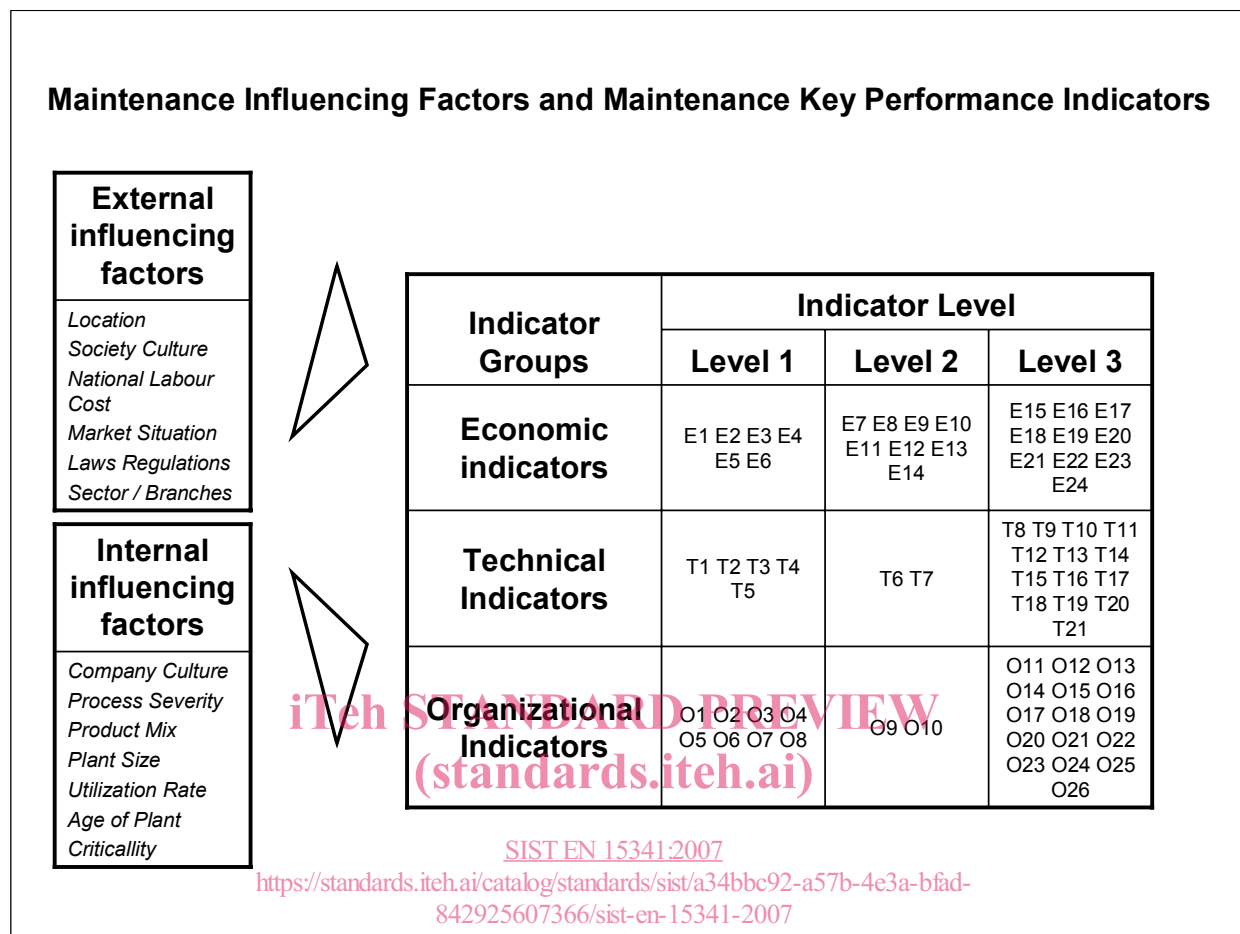
Figure 1 illustrates the external and internal factors that influence maintenance performance and consequently the three groups of key indicators.

External factors are variable conditions outside company management control.

Internal factors are referred to the group, company, factory, plant outside of the maintenance management control, but inside of the company management control.



When using the key maintenance performance indicators, it is important to consider these influencing factors as prerequisites to avoid misleading evaluations and comparisons due to not having homogeneous conditions.



**Figure 1 —Maintenance influencing factors and Maintenance Key Performance Indicators**

## 6 Indicators

### 6.1 General

When calculating the indicators, denominator and numerator, factors shall be referred to the same activity/item and to the same period of time (year, quarter, month, etc.). These factors are defined and explained in Annex A of this document.

Most indicators can be used at different levels depending on whether they are used to measure the performance of plant production, one production line, or a given equipment or item, etc.

The indicators in this standard are structured in levels that represent their breakdown structure. Indicators below level one are a detailed description of indicators at a higher level. The magnitude and number of levels may be established by each company.

The indicators in this standard are numbered by level as a means of identification, not to indicate importance.

These indicators refer to internal maintenance, external maintenance or both.

The term “Time” is generally used to describe time units related to equipment and its performance.

The terms “Hours” or “Man-hours” describes the hours delivered to maintenance activities.

**6.2 Economical Key Indicators**

**6.2.1 LEVEL 1**

E1	$\frac{\text{Total Maintenance Cost}}{\text{Assets Replacement Value}}$	x 100
E2	$\frac{\text{Total Maintenance Cost}}{\text{Added value plus external costs for maintenance}}$	x 100
E3	$\frac{\text{Total Maintenance Cost}}{\text{Quantity of output}}$	
E4	$\frac{\text{Total Maintenance Cost}}{\text{Production transformation cost}}$	x 100
E5	$\frac{\text{Total Maintenance Cost} + \text{unavailability costs related to maintenance}}{\text{Quantity of output}}$	
E6	$\frac{\text{Availability related to maintenance}}{\text{Total Maintenance Cost}}$	

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**6.2.2 LEVEL 2**

E7	$\frac{\text{Average inventory value of maintenance materials}}{\text{Asset Replacement Value}}$	x 100
E8	$\frac{\text{Total internal personnel cost spent in maintenance}}{\text{Total Maintenance Cost}}$	x 100

E9	$\frac{\text{Total external personnel cost spent in maintenance}}{\text{Total Maintenance Cost}}$	x 100
E10	$\frac{\text{Total contractor cost}}{\text{Total maintenance cost}}$	x 100
E11	$\frac{\text{Total cost of maintenance materials}}{\text{Total maintenance cost}}$	x 100
E12	$\frac{\text{Total cost of maintenance materials}}{\text{Average inventory value of Maintenance materials}}$	= Warehouse turnover
E13	$\frac{\text{Cost for indirect maintenance personnel}}{\text{Total Maintenance Cost}}$	x 100
E14	$\frac{\text{Total Maintenance Cost}}{\text{Total Energy Used}}$	
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<b>6.2.3 LEVEL 3</b>		
E15	$\frac{\text{Corrective maintenance cost}}{\text{Total Maintenance Cost}}$	x 100
E16	$\frac{\text{Preventive maintenance cost}}{\text{Total Maintenance Cost}}$	x 100
E17	$\frac{\text{Condition based maintenance cost}}{\text{Total Maintenance Cost}}$	x 100
E18	$\frac{\text{Predetermined maintenance cost}}{\text{Total Maintenance Cost}}$	x 100
E19	$\frac{\text{Improvement maintenance cost}}{\text{Total Maintenance Cost}}$	x 100
E20	$\frac{\text{Maintenance shutdown cost}}{\text{Total Maintenance Cost}}$	x 100

E21	$\frac{\text{Cost of training for maintenance}}{\text{Number of maintenance personnel}}$	unit of value / person
E22	$\frac{\text{Total Mechanical maintenance contractor costs}}{\text{Total maintenance contractor costs}}$	x 100
E23	$\frac{\text{Total Electrical maintenance contractor costs}}{\text{Total maintenance contractor costs}}$	x 100
E24	$\frac{\text{Total Instrumentation maintenance contractor costs}}{\text{Total maintenance contractor costs}}$	x 100

### 6.3 Technical key indicators

#### 6.3.1 LEVEL 1

T1	$\frac{\text{Total Operating time}}{\text{Total Operating time} + \text{Downtime due to maintenance}}$	x 100 (availability related to maintenance)
T2	$\frac{\text{Achieved up time during required time}}{\text{Required time}}$	x 100 (operational availability)
T3	$\frac{\text{Number of failures due to maintenance creating environmental damage}}{\text{Calendar time}}$	
T4	$\frac{\text{Annual volume of wastes or harmful effects related to maintenance}}{\text{Calendar time}}$	
T5	$\frac{\text{Number of injuries for people due to maintenance}}{\text{Working time}}$	

#### 6.3.2 LEVEL 2

T6	$\frac{\text{Total operating time}}{\text{(Total operating time} + \text{Downtime related to failures)}}$	x 100
T7	$\frac{\text{Total operating time}}{\text{(Total operating time} + \text{Downtime related to planned and scheduled maintenance)}}$	x 100