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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Automated urban guided transport (AUGT) – Safety requirements

Applications ferroviaires – Transports guidés urbains automatiques (AUGT) – Exigences de sécurité

IEC 62267:2009

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – AUTOMATED URBAN GUIDED TRANSPORT (AUGT) – SAFETY REQUIREMENTS

FOREWORD

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This International Standard has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard cancels and replaces IEC/PAS 62267:2005.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/1261/FDIS	9/1272/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This International Standard is a generic guideline providing recommendations to assist railway authorities and safety regulatory authorities to define safety requirements appropriate to AUGT systems. The generic requirements recommended in this standard are based on the experience gained from AUGT systems already in operation. Safety requirements for each specific application, however, can only be defined from the results of a risk analysis, taking into consideration the conditions in which the AUGT system is to be set up and based on the risk acceptance principles prevailing in the local environment. The standard applicable for conducting a mandatory and comprehensive risk analysis of an AUGT system is IEC 62278 (RAMS).

In view of the diversity of the technical solutions that may be adopted for new AUGT systems and the diversity of operational conditions, the list of generic hazardous situations considered in this standard should be regarded as a minimum list. The requirements for a safeguard as described in this standard are intended as minimum requirements in case a specific safeguard is applied to mitigate the related hazardous situation. However, the specific risk analysis may show that some requirements of a chosen safeguard should be modified to take into account some specific conditions. Each specific design of the new AUGT system and each aspect of the specific topographic, environmental, social or legal environment of the new AUGT system can also generate new hazards and therefore may require additional safety requirements. A specific hazard analysis to identify additional requirements or requirements to be modified is therefore always a necessity.

This standard, therefore, does not and could not prescribe any specific means that could, without a fail, mitigate risks arising from hazardous situations. Rather, it identifies a list of foreseeable hazardous situations, derived from the elementary consideration that functions assumed by the driver and staff in conventional systems are replaced in AUGT systems by automated functions or other safeguards. It is the purpose of this standard that this list of hazardous situations should be carefully considered during the risk analysis carried out for any new AUGT system.

In addition to generic hazardous situations, this standard also describes possible and widely implemented safeguards that the specific risk analysis may well show to be adapted to the specific application.

It should be noted that not all hazardous situations identified in the context of one or other of the large number of different AUGT systems already in operation in the world have necessarily been covered in this standard. Nor would it have been necessarily helpful. Neither could this standard describe all the possible safeguards demanded by each and every specific application.

This standard does not require that a safeguard be put in place for every generic hazardous situation identified. This is because often, the risk associated with a hazardous situation may be assessed as tolerable without the need for a safeguard. According to IEC 62278, it is the responsibility of the railway authority, in agreement with the Safety Regulatory Authority having jurisdiction, to decide on the tolerability of each risk and on the necessity of a specific safeguard, taking into account their specific risk acceptance criteria and legal requirements that are applicable for the specific AUGT application.

RAILWAY APPLICATIONS – AUTOMATED URBAN GUIDED TRANSPORT (AUGT) – SAFETY REQUIREMENTS

1 Scope

This International Standard covers high-level safety requirements applicable to automated urban guided transport systems, with driverless or unattended self-propelled trains, operating on an exclusive guideway.

This standard only deals with the safety requirements needed to compensate for the absence of a driver or attendant staff who would otherwise be responsible for some or all of train operation functions (see Table 1), depending on the level of automation of the system (see shaded areas in Table 1 and see 3.1 for a definition of the different grades of automation).

The requirements of this standard are restricted to transports systems as defined in Clause 5 and to DTO and UTO as defined in 3.1.4 and 3.1.20, respectively (see the shaded areas in Table 1).

Table 1 – Grades of automation

Basic functions of train operation		On-sight train operation TOS	Non-automated train operation NTO	Semi-automated train operation STO	Driverless train operation DTO	Unattended train operation UTO
		GOA0	GOA1	GOA2	GOA3	GOA4
Ensuring safe movement of trains	Ensure safe route	X (points command/ control in system)	S	S	S	S
	Ensure safe separation of trains	X	S	S	S	S
	Ensure safe speed	X	X (partly supervised by system)	S	S	S
Driving	Control acceleration and braking	X	X	S	S	S
Supervising guideway	Prevent collision with obstacles	X	X	X	S	S
	Prevent collision with persons	X	X	X	S	S
Supervising passenger transfer	Control passengers doors	X	X	X	X or S	S
	Prevent injuries to persons between cars or between platform and train	X	X	X	X or S	S
	Ensure safe starting conditions	X	X	X	X or S	S
Operating a train	Put in or take out of operation	X	X	X	X	S
	Supervise the status of the train	X	X	X	X	S
Ensuring detection and management of emergency situations	Perform train diagnostic, detect fire/smoke and detect derailment, handle emergency situations (call/evacuation, supervision)	X	X	X	X	S and/or staff in OCC

NOTE

X = responsibility of operations staff (may be realised by technical system).

S = realised by technical system.

This standard does not specifically look at security issues. However, aspects of safety requirements may apply to assuring security within the transport system.

NOTE The definitions of “security” and “safety” are given by IEC 62278.

Application of this standard is subsidiary to the responsibility of the transport authority and the safety regulatory authority (see IEC 62278) and to the specific laws and decrees applicable within the prevailing environment (economic, social, political, etc.) where the transport system is located, taking into account:

- social risk acceptance in different cultures or different national legal regulations (e.g. SHOREI, BOStrab) or principles (e.g. GAME, ALARP);
- laws and decrees in different states;
- special or different requirements specified by the safety regulatory authority or by an independent assessor in charge of the specific application;

- the responsibility for "safe operation" by the transport authority.

This standard does not apply to the following types of transport systems, unless specifically required by the Transport Authority:

- APMs (Automated People Movers) operating entirely inside a privileged environment such as an airport, a commercial centre or a leisure resort;
- amusement rides and roller-coasters, generally featuring a single station so that passengers board and alight the system at the same location;
- intercity and mainline train services, generally operating in a rural environment on part of their routes;
- cable-driven systems;
- systems featuring electronically guided vehicles with optical sensors, magnetic sensors, or similar devices/systems.

This standard is not concerned with risks arising during works for construction, installation, modification and dismantling of a system.

This standard is not concerned with pre-existing DTO or UTO systems (see definitions in 3.1) that were designed before this standard took effect.

In the case of upgrading an existing transport system to a DTO or UTO system, the risks associated with the existing system are outside the scope of this standard. However, this standard and the risk analysis process described are relevant for the additional subsystems and possibly for the transition process itself. Therefore, the application of the standard is at the discretion of the safety regulatory authority.

In the case of extending or modifying an existing DTO or UTO system in operation, this standard applies only if the change is significant as determined by the safety regulatory authority. However, the risks due to the relationship with the unchanged parts of existing systems (e.g. rolling stock, traction power supply, signalling and platforms) should be taken into account.

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.

IEC 62278:2002, *Railway applications – Specification and demonstration of reliability, availability, maintainability and safety (RAMS)*

IEC 62290-1, *Railway applications – Urban guided transport management and command/control systems – Part 1: System principles and fundamental concepts*

IEC 62425, *Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1
Automated Urban Guided Transport
AUGT
system featuring driverless or unattended train operation (as defined below) with self-propelled, guided vehicles, operating on an exclusive guideway

3.1.2
conventional system
system operated in TOS, NTO or STO

3.1.3
doors closed and locked
doors are considered as being in a closed and locked state if they cannot be opened by passengers

3.1.4
Driverless Train Operation
DTO
train operated with operations staff present on board the train but not accelerating or braking and not responsible for observing the guideway in front of the train and stopping the train in case of a hazardous situation. Safe departure of the train from the station, including door closing, is either the responsibility of operations staff or of the technical system

3.1.5
exclusive guideway
guideway intended to be used only by one transport system without interference with other types of transport systems

3.1.6
grade of automation
automation level of train operation resulting from sharing responsibility for given basic functions of train operation between operations staff and technical system

3.1.7
guideway clearance
pre-defined space around the track defined relatively to the track and such that trains in motion cannot, while under operating conditions, come into contact with persons or property fully outside this space

3.1.8
Non-automated Train Operation
NTO
train operation where the driver (i.e., train operator) is in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking are controlled by the driver in conformance with wayside signals or cab-signalling. The signalling system supervises the activities of the driver. This supervision may be discrete, semi-continuous or continuous. Safe departure of the train from the station, including door closing, is the responsibility of the operations staff whether on board the train or on the station platform

3.1.9
On Sight Train Operation
TOS
train operation where the driver has full responsibility and no technical system is required to supervise his activities. However, points (switches) and single tracks can be partially supervised by the system

3.1.10
Operations Control Centre
OCC
centre from which operation of the line or the network is supervised and managed

3.1.11
passenger cabin
part of the train used for carrying passengers

3.1.12
passenger transfer area
area of the platform directly adjacent to the guideway clearance intended for the passage of passengers during transfer between the platform waiting area and a train

3.1.13
passenger transfer door
train door which provides access for passenger transfer between the passenger cabin and a station platform; can also be used as an emergency exit in cases of hazardous situations (e.g. fire, hazardous fumes)

3.1.14
platform track
area of track located in a station in front of the platform (see Figure 2)

3.1.15
platform waiting area
area of platform where passengers wait for approaching trains, separated from the guideway clearance by the passenger transfer area

3.1.16
safety space
area beside the guideway clearance where persons can shelter and not be endangered by moving trains

3.1.17
Semi-automated Train Operation
STO
train operation where operations staff is located in the front cabin of the train observing the guideway and stopping the train in case of a hazardous situation. Acceleration and braking is automated and the speed is supervised continuously by the system. Safe departure of the train from the station is under the responsibility of the operations staff, whether on board the train or on the station platform

3.1.18
transfer area
area where the transfer of a train between automated and non-automated areas is made

3.1.19
transport authority
entity which is responsible for safe and orderly operation of a transport system

NOTE For safety aspects, the term “transport authority” is equivalent to the term “railway authority” as used in IEC 62278.

3.1.20
Unattended Train Operation
UTO
train operated without any operations staff on board (all functions are the responsibility of the technical system)

3.1.21
zero speed status
safety-related information indicating that the speed of the train is below a pre-defined limit whereby the system considers the train as stopped

3.2 Abbreviations

ALARP	As Low As Reasonably Practicable
AUGT	Automated Urban Guided Transport
DTO	Driverless Train Operation
GAME	Globalement Au Moins Equivalent (French safety principle meaning “globally at least equivalent”)
GOA	Grade Of Automation
NTO	Non-automated Train Operation
OCC	Operations Control Centre
SRA	Safety Regulatory Authority
STO	Semi-automated Train Operation
TA	Transport Authority
TOS	On-sight Train Operation
UTO	Unattended Train Operation

4 Methodology

Methodology used for deriving generic safety requirements given in this standard is based on the principles of life cycle phases described in IEC 62278. Figure 1 below shows the V representation of system life cycle and highlights the activities of the methodology.

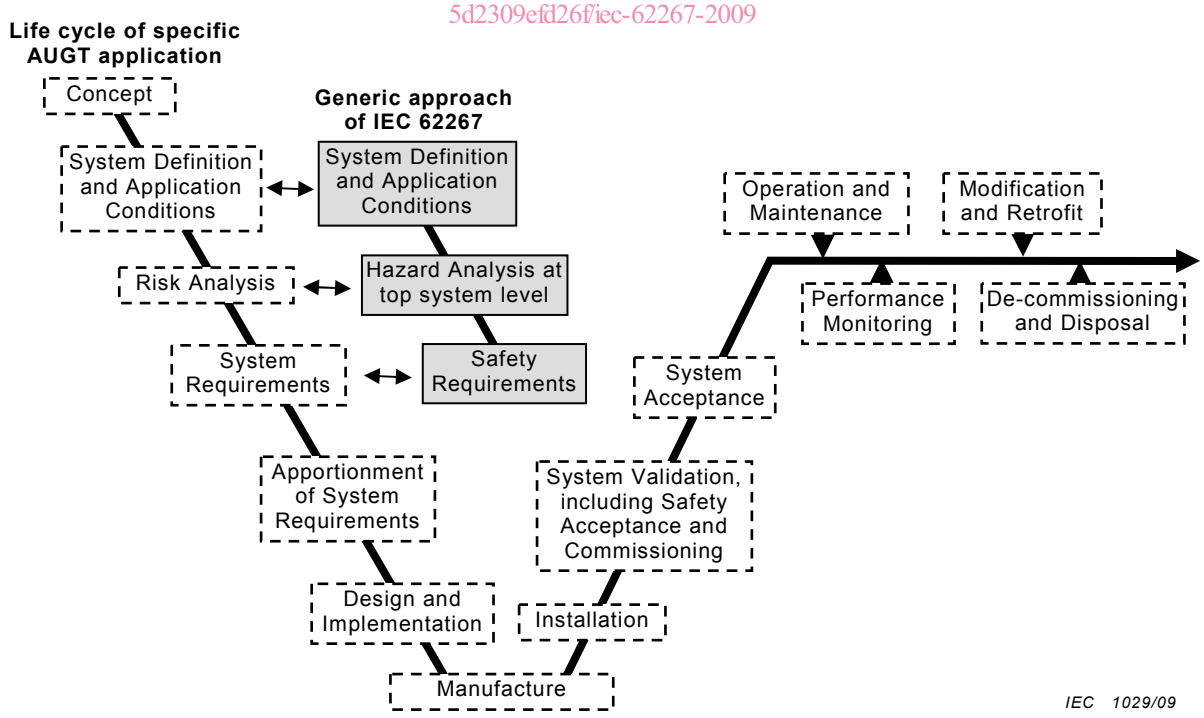

Figure 1 – Life cycle phases covered by this standard (see Figure 10 of IEC 62278)

The methodology consists of the following sequence of activities (shown by the shaded areas in Figure 1):