ARGE Guideline - Part 3

“System functionality of fire detection and fire fighting systems in railway vehicles”

Specification of minimum requirements and guideline for qualification of fire protection technology

Rev.-No.	Date	Responsible	Comment
1.0	11-19-2009	ARGE	Adoption
2.0	09-17-2012	ARGE	Update
3.0	09-10-2018	ARGE	Specification of the assessment
3.1	15.11.2018	ARGE	Update

This Guideline is the result of a cooperation of the Detection Technology Consortium (ARGE)

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1. General

The purpose of the Guideline is to specify the minimum requirements and the method of qualification for the integration of active fire protection technology (i.e. fire detection systems, fire suppression systems and fire extinguishing systems) within rail vehicles. It specifies the interface regarding the communication between fire detection and fire fighting systems as well as the control system.

To ensure the provision of a complete planning for the installation of active fire protection systems in railway vehicles, basic requirements for design, construction and a method of assessment are required.

Note: The ensured continuance of the reliability of the systems are the result of the manufacturer’s requirement specification(s). To guarantee the system reliability the maintenance instructions provided by the manufacturer must be followed.

The basic requirement of the application of ARGE Guideline Part 3 is the fulfilment of

- ARGE Guideline Part 1 and
- ARGE Guideline Part 2, if fire fighting and fire extinguishing is applicable.

The rules and standards reffered to in the present document are valid in their latest version.

1.1. Preface

The Technical Specifications for Interoperability (TSI), the current state of the art and the European Standard EN 45545-6 include requirements for the installation of fire detection systems. Few requirements for the assessment procedure are included in the European Standard EN 50553. The purpose of EN 50553 is to define requirements for railway vehicles in terms of running capability in case of fire, whereas the ARGE Guideline focuses on the aim “to protect passengers and staff”. Thus, the ARGE assessment procedures are more conservative than the requirements in EN 50553.

To ensure the provision of a complete planning for the installation of fire detection systems in railway vehicles, system specific requirements for design, construction and a method of assessment are required.

1.2. Objectives

This Guideline specifies the necessary criteria for an assessment of the complete system.

The focus is on the fire detection, fire suppression and fire extinguishing system in connection with the train control and management system (TCMS).

The correct interaction between the control system and the relevant subsystems must be fully tested according to the vehicle specifications and must be fully aligned with those requirements. The test criteria defined in this Guideline are the basis for the final type tests or the approval test of the complete fire detection, fire fighting and fire extinguishing system. A method of project management according to the International Railway Industry Standard (IRIS) and the development of a system concept regarding EN 50126 are required (V-model).

1.3. Scope

The purpose of the Guideline is to design and assess the system functionality of fire detection, fire fighting and fire extinguishing systems.

The assessment is realized by

- documentation of the active fire protection systems (e. g. system description, RAMS analysis)
- type test
- evaluation of conformity (document)

and will be confirmed by an officially recognized railway assessor/expert/test center in collaboration with the manufacturer and supplier.

The vehicle manufacturer is responsible for the specification and realization of the type test. The system supplier supports the manufacturer.

1.4. Validity

This Guideline applies to the use in railway vehicles and other track guided systems equipped with fire suppression and fire extinguishing systems.

As necessary the Guideline can be applied to comparable technical systems (e. g. buses).

2. Specification/Concept

2.1. Functional requirements for interfaces

The following requirements for the interfaces between the system(s) and the railway vehicle must be specified by the vehicle manufacturer and must be adopted in the technical implementation and documentation by the system manufacturer:

- Definition of the safety classification, or further system functionalities, with respect to the ARGE Guideline by the vehicle manufacturer or operator (recommendation: Expert assessment of the classification regarding plausibility).
- Definition of the energy supply, depending on, among other things, the system safety classification in compliance with the vehicle-related and system-specific design.
- Definition of the environmental conditions regarding place of installation and functional requirements with respect to the defined environmental conditions, e. g. based on the temperature classification according to EN 50125.
- Definition of reliability, availability and maintainability requirements (RAM) of the active fire protection system regarding operational requirements (e. g. system specification provided by the vehicle operator including information of RAM parameters, calculation of the parameters according to EN 50126).

  (e. g. inspection, maintenance, preventive change of components).
- Definition of the external and internal interfaces (e. g. Human-Machine-Interface (HMI) for example displays, audio system, controls) for signal or mode transmission concerning
  - operation and fault reporting,
  - alarm in the vehicle or compartments inside or outside the vehicle,
- Definition of necessary activation of vehicle components and functions (e. g. HVAC unit, end doors, shut down of technical equipment, activation of communication systems).

Generally, impacts on safety relevant vehicle equipment (e. g. in signal transmissions on the vehicles data bus) must be prevented by active fire protection systems.

Note: Based on the fire protection concept, the vehicle manufacturer specifies the requirements for the system manufacturer concerning alarm activation and control of further technical equipment in the vehicle. The vehicle manufacturer has to consider the state of the art.

Note: The specifications of the vehicle manufacturer or operator do not release the system supplier from meeting legal and normative requirements (e. g. EMC Directive, Directive for Pressure Purposes, Pressure Equipment Directive, technical compatibility of the extinguishing medium without health risks).

2.2. Functional requirements for signal transmission

2.2.1. Basic function system availability

The requirements for the technical equipment are defined as follows:

- Availability of system modes
  - signal output of system availability, transmission to signaling transfer point
    → necessary for normal mode operation without restrictions.
  - signal output of possible system incidents, transmission to signaling transfer point
    → degraded mode operation is still possible or the availability is cancelled.
  - signal output of alarms, transmission to signaling transfer point
    → basis for subsequent operations according to instructions for staff by the vehicle operator.
- Monitoring system availiability.
- Availability of possibly activating external switching operations at interfaces.
- The fault indication can be summarized for the transmission to the leading vehicle.

Signaling transfer points are monitors, visual and acoustic alarm systems and in single cars connections of data lines.

Note: Signal transmission can be realized by compensating technical solutions (e. g. in passenger trains with a locomotive which apply standard protocols) or the signal transmission can be compensated by operational processes (e. g. trained staff). Operational specifications for fire detection and fire suppression systems are important when deviating from "Basic function of system availability" mentioned above.

2.3. Basic alarm function

The requirements for the alarm are defined as follows:

- Fire alarm must be visually and acoustically transmitted to the staff (driver and/or staff on board) according to the concept of operation (assigned job to the staff).
- A local alarm must be signaled in the passenger compartment, if there is the possibility that a fire may develop un-noticed, such as restricted visibility in the passenger compartment. In sleeping and couchette vehicles, in double decked vehicles and WCs an acoustic alarm system must be installed. In addition, in sleeping and couchette vehicles a visual alarm system must also be installed.
- The driver must be informed when a fire suppression or fire extinguishing system is activated (e. g. including a realized shut down of the equipment which is affected by the fire).
- Alarm messages can be summarized for transmission to the leading vehicle.

2.4. Maintaining the function

The monitoring requirement of the system mode is the result of the project specific safety review, but as a minimum the requirements according to EN 54-2 (control and indicating equipment) and EN 12094-1 (gas extinguishing systems) must be fulfilled, as far as required for railway vehicles.

To ensure the function during operation, the system must be checked and maintained according to written instructions provided by the system manufacturer.

The system will be functional, if data transmission from the interface of the fire protection system to the defined alarm and fault signaling works correctly. The system mode must be monitored.

Note: The vehicle manufacturer is responsible for monitoring the alarm and fault transmission.

3. Assessment

3.1. Independent evaluation

The evaluation complies with the appropriate approval process of the railway vehicle, for example:

- inspection body ISO/IEC 17020 Type A, accredited as specialist for fire safety in railway vehicles, with European evaluations of conformity according to the Technical Specifications for Interoperability (TSI),
- expert which is acknowledged by the appropriate body in the national approval process or
- other national acknowledged bodies.

This also applies to deviations from evaluation criteria mentioned in this Guideline.

Note: The test should be performed by a test center which is acknowledged according to ISO/IEC 17025, accredited according to this Guideline.

3.2. Minimum requirement (RAM)

The required functions mentioned in chapter 2 must be assessed as follows:

- For single cars, this is provided at least at the signaling transfer point of signals to the vehicle in the immediate vicinity. The defined alarm and fault signaling must be checked.
- For non separable train sets, the defined alarm and fault signaling must be checked.
- The defined RAM parameters must be assessed as follows:
  - inherent pre-calculations of reliability
  - FMECA
  - FTA
  - preliminary risk analysis for maintenance instructions

If RAM parameters are not defined, reliability must be pre-calculated at least according to IEC TR 62380. Evaluation of field data of comparable applications can be taken into account, as well.

3.3. Demonstration of safety

Safety must be demonstrated according to EN 50126 or another applicable process which is officially recognized by the notified body (e. g. IEC 61508, safety regulations (SIRF)) or comparable rules, if an evaluation of potential risks is required.
For testing, the potential fire risks must be taken into account.

4. Editorial work and revisions of the Guideline

ARGE is exclusively responsible for changes and updates of the Guideline as a result of technical discussions and exchange of experiences. Current findings in connection with the application of the Guideline are taken into account.

The leading editorial work is supervised by TÜV SÜD.

TÜV NORD ensures the 4-eyes principle.

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FOGTEC Brandschutz GmbH & Co. KG

IFAB GmbH

IME Elektrotechnik GmbH

KIDDE-DEUGRA Brandschutzsysteme GmbH

TÜV NORD Systems GmbH & Co. KG

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WAGNER Rail GmbH / Schweiz AG

Consortium meetings	**Date**	**Location**
1st consultation – Kick Off and wording of RILI	11-19-2009	Ahrensburg
2nd consultation – Revision	06-19-2012	Berlin
3rd consultation – Revision	2018	Munich-Haar and Dortmund