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TÜRASAS Fire Classification Of The Unit And Fire Prevention General Requirements

[Gaziray Project]

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1 SUBJECT

The purpose of this document is to provide a description of the fire behaviour both for Passenger Compartment and Driver Cabin.

2 APPLICABLE TECHNICAL REQUIREMENT DOCUMENT

Rif.	N.° Documento	Descrizione	
[1]	TŞ-01.0139 General technical Specification	Technical requirements	
[2]	INTERNAL LAYOUT	CAD Drawing	
[3]	TSI Loc/Pass	Technical Specifications for Interoperability relating to “rolling stock - Locomotives and Passenger Rolling Stock” sub-system of the Trans-European rail system	
[4]	EN 45545-1:2013	Railway applications. Fire protection on railway vehicles. General	
[5]	EN 45545-2:2020	Railway applications. Fire protection on railway vehicles. Requirements for fire behaviour of materials and components	
[6]	EN 45545-3:2013	Railway applications. Fire protection on railway vehicles. Fire resistance requirements for fire barriers	
[7]	EN 45545-4:2013	Railway applications. Fire protection on railway vehicles. Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles	
[8]	EN 45545-5:2013+A1:2015	Railway applications. Fire protection on railway vehicles. Fire safety requirements for electrical equipment including that of trolley buses, track guided buses and magnetic levitation vehicles	
[9]	EN 45545-6:2013	Railway applications. Fire protection on railway vehicles. Fire control and management systems	
[10]	EN 13272-1:2019	Railway applications - Electrical lighting for rolling stock in public transport systems - Part 1: Heavy rail	
[11]	EN 13272-2:2019	Railway applications - Electrical lighting for rolling stock in public transport systems - Part 2: Urban rail	
[12]	EN 14752:2019	Railway applications - Bodyside entrance systems for rolling stock	
[13]	UIC 642	Special provides concerning fire precautions and fire fighting measures on motive power units and driving trailers in international traffic	

3 VEHICLE MAIN DATA

Total Length [mm]	96000
SKA length	24605
OA length	22680
Width [mm]	2950
Height [mm]	2250
SKA Passenger Windows for each coach	12
OA Passenger Windows for each coach	16
Doors for each coach	8
Total seats	204
Total passenger standing	810 (AW3)
Total Passengers	1014 (AW3)

Table 1 –Cars Dimensions

Length [mm]	2330
Width [mm]	2950
Height [mm]	2250
Windows	2
Windscreen	1
Doors	2
Passengers	2

Table 2 –Driver Cabin Dimensions

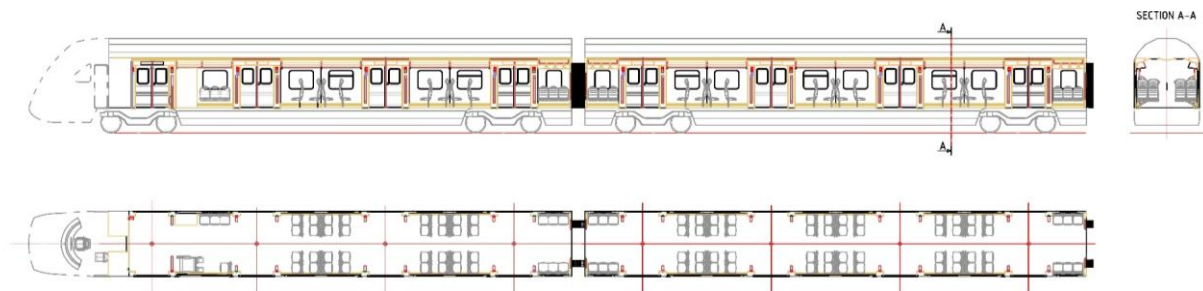


Figure 1 – EMU basic data

4 FIRE BEHAVIOUR CLASSIFICATION

4.1 Regulatory framework

The car will comply with the following safety standard:

- TSI Loc&Pass & SRT “Safety in Railway tunnels”
- EN 45545-1-6;• Fire protection on the rail vehicles
- UIC 642 Special provides concerning fire precautions and fire fighting measures on motive power units and driving trailers in international traffic

4.2 Vehicle classification

The vehicle classification refers to the categories defined by the TSI and, consequently, by the EN 45545 standard.

According to the TSI, the train has to be classified as category A, as it must work in tunnels not longer than 5 km. For the same reason, according to EN 45545-1, the train has to be classified as:

- Standard vehicle: N
- Operation category: 2(side evacuation available and tunnels not greater than 5 km)

So the vehicle results to be classified as 2N, and this implies a hazard level equal to **HL2**.

4.3 Running capability

The requirement of running capability is expressed in the TSI LOC&PAS and in the standard EN 45545-1.

The train should be able to keep the running capability for a time of 4 min.

According to TSI LOC&PAS, braking functions shall be guaranteed for a duration of 4 minutes.

5 MATERIALS REQUIREMENT FOR FIRE RESISTENCE BEHAVIOUR

5.1 Materials classification in fire behaviour

5.1.1 Fire resistance behaviour

According to TSI LOC&PAS materials requirements for fire resistance behaviour are expressed through the index R(n) described in the standard EN 45545-2, “Table 5”. To correctly define the requirements it is necessary to know the hazard level of the train that, in this case, is HL2.

These requirements for materials depend not only on the component intrinsic nature, but also on the position, shape and layout, surface exposure, relative mass and thickness of the material considered. To identify the relevant R (n) requirements, in "Table 2" of the standard EN 45545-2 several products and their position on the train are listed.

In the table below the material requirements for the components of the cars are reported.

Name	Applicable Product type (No)	Definition	Details	Requirement
Bogie monoblock wheel	EX10	Parts of the drive	Wheel sets and brake discs	R9
Bogie axle	EX10	Parts of the drive	Wheel sets and brake discs	R9
Axle box	EX10	Parts of the drive	Wheel sets and brake discs	R9
Bogie wheelset	EX10	Parts of the drive	Wheel sets and brake discs	R9
Current return device	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
Elastic element for axlebox	EX10	Parts of the drive	Wheel sets and brake discs	R9
Trailing rod elastic components	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Rocker arm elastic element	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Rolling support	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Primary suspension elastic disc	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Bogie primary suspension	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Bogie secondary suspension	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
	EX9	Airbags for pneumatic suspension	NOTE: elastomeric parts assimilated to airbags	R9

Bogie suspension dampers	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
Tie rod for anti roll-bar	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Anti roll-bar	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Primary suspension spring assembly	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Anti-rollbar assembly	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
Bogie & Bogie-Body connections	EX8	Bogie structure and parts	The bogie structure shall include frames, spring leaf guides and bolster	R7
	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
Body-Body connections	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16

Gangway	EX7	Exterior surfaces of gangways	Outer membrane of intercommunication gangways.	R7
	IN6A	Interior surface of gangways. Type A - For railways vehicles in which there are no fire barriers at both bulk head ends of the gangways.	Interior side of gangway membrane (bellow), interior lining of the gangway, (except flooring).	R1
	IN16	Interior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R22
Bogie brake components	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
Lubricating device	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
Automatic Coupler	EX8	Bogie structure and parts	The bogie structure shall include frames, spring leaf guides and bolster	R7
	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
Pneumatic Brake System and Air production	M1	Flexible metal/rubber unit	Flexible metal/rubber unit including elements in bogies	R9
	M2	Hoses - Interior	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R22

	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
Thermal and Noise Insulation Provisions and materials	IN1A	Interior vertical surface	Insulation material and interior surface of body shell	R1
	IN1B	Interior horizontal downward-facing surfaces	Insulation material and interior surface of body shell	R1
	IN1C	Interior horizontal upwards-facing surfaces	Insulation materials and interior surface of body shell. Compliance with the requirements of R1 is also considered to be compliant for this requirement	R10 or R28 (*)
Fire Protection	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
	M2	Hoses - Interior	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R22

PIS (Passenger Information System)	IN14	Device for passenger information	Information display screens in passenger areas, not these in staff areas. Products such as speakers, handsets and their holders shall be considered as non-listed products (R7).	R1
	EX13	Light diffuser and display screen cover	Head light and tail lights, cover of display screen	R27
	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
Auxiliary System	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	EL09	Printed Circuit boards	Printed circuit boards with all varnishes applied but without any attached technical equipment	R24 or R25
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26

	Refer also to EN 45545-5			
Battery	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
	Non-Listed	Battery Cell	Exposed area > 0,20 m ² location Exterior	R7
	Refer also to EN 45545-5			
Lateral panel (interiors)	IN1A	Interior vertical surface	Interior components (structure and covering) such as side walls, front walls, / end walls, partitions. Insulation material and interior surface of body shell.	R1
Sidewall (External bodyshell)	EX1A	Walls of external body shell	Vertical parts of external structure of body shell and door leafs (including paint/coating systems, films and windows)	R7
Underframe	EX3	Under frame of external body shell	External surfaces of under frame structure of body shell (floor) including paint and coating systems (thermal, design and acoustic coating) and protective floor paneling	R7

Floor	IN1C	Interior horizontal upwards-facing surfaces	Interior components (structure and covering) such as flaps, paneling, flaps, boxes, hoods, louvers. Insulation materials and interior surface of body shell. Compliance with the requirements of R1 is also considered to be compliant for this requirement	R10 or R28(*)
	IN15	Floor composites	The floor composites include the floor substrate (together with any thermal insulation) and floor covering (together with any fixings or adhesives applied in end use conditions).	R10
Ceiling	IN1B	Interior horizontal downward-facing surfaces	Interior components (structure and covering) such as flaps, panelling, flaps, boxes, hoods, louvers. Insulation materials and interior surface of body shell.	R1
Roof	EX2	Roof of external body shell	External roof structure of the car body (including paint/coating systems, films). Compliance with the requirements of R7 is also considered to be compliant for this requirement	R8
Passenger external doors	EX1A	Walls of external body shell	Door leafs (including paint/coating systems, films and windows)	R7

	EX12	Exterior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R23
	IN16	Interior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R22
	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
Driver internal door	IN1A	Interior vertical surface	Interior doors, interior lining of the front-/end-wall doors and external doors	R1
Passenger Areas Internal doors	IN1A	Interior vertical surface	Interior doors, interior lining of the front-/end-wall doors and external doors	R1
	IN16	Interior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R22
	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26

	EL9	Printed circuit boards	Printed circuit boards without any attached technical equipment	R24 or R25 or R26
Compartment Windows	EX1A	Walls of external body shell	Vertical parts of external structure of body shell and door leafs (including paint/coating systems, flms and windows)	R7
	EX12	Exterior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R23
	IN16	Interior seals	Longitudinal seals such as windows seals, door joints, panel connections.	R22
	IN7	Windows frame	Window surround (including sealants and gaskets)	R1
	INT1A	Interior vertical surface	Windows (including plastic and glazing)	R1
Passenger Seats	From F1 to F1E	Complete passenger seats	See details in the EN 45545-2, table 2	R18, R21, R6
	F4	Loose upholstery items for seats, couchettes and beds (IF ANY)	Antimacassar > 0.20 m ²	R1
			Antimacassar ≤ 0.20 m ²	R22
Driver Seats	F2	Seats in staff areas	Staff seat upholstery and supporting structure (including the back/base shell) shall be tested according to the following conditions: - top surface of seat; - back shell from external surface; - external surface of base shell. Test in the end use conditions referring to guidance	R19

			in Annex A. If the fire integrity condition of 5.2.2.2 (EN 45545-2) is additionally met, then it is not necessary to test the shell/upholstery composite from the shell face. Whole seat is qualified if the requirement set R19 is met. No further tests required.	
Luggage compartment	IN4	Luggage storage areas	Overhead luggage racks, vertical luggage racks, luggage stacks, luggage containers and luggage compartments.	R1
PRM Area Fittings	Refer to EN 45545, figure 1			
Traction and Electrodynamic Braking	M2	Hoses - Interior	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R22
	M3	Hoses-Exteriors	Pipes and hoses for fuel, oils, hydraulics, pneumatics, water and drainage	R23
	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	EL10	Low power electro technical and electronic products	Examples include low power circuit breakers, R26 overload relays, contactors, contactor relay, switches, control or	R26

			signaling switches, terminals, fuses	
	Refer also to EN 45545-5			
Power System equipment	Refer also to EN 45545-5			
	EL5	Supply line system devices - Exterior	Surge arresters; isolators; switches; main circuit breakers	R23
	EL6A	Supply line system and high power devices - Interior	Isolators; current and voltage transformers, main circuit breakers; contactors	R22
	EL6B	Supply line system and high power devices - Exterior	Isolators; current and voltage transformers, main circuit breakers; contactors	R23
Transformer	EL6A	Supply line system and high power devices - Interior	Isolators; current and voltage transformers, main circuit breakers; contactors	R22
	Refer also to EN 45545-5			
TCMS (Train Control & Monitoring System)	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	Refer also to EN 45545-5			
Electrical cabinets	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26

	Refer also to EN 45545-5			
Internal Lights System	IN3B	Light diffusers	For example, polycarbonate diffusers, light coverings for lamps. Light units themselves and indicators are not within the scope of INB3.	R4
	EL10	Small electrotechnical products	Examples include low power circuit breakers, overload relays, contactors, contactor relay, switches, control or signaling switches, terminals, fuses	R26
External Lights System	EL1A	Cables for interior	Cables not compliant with one of the standards referenced in 4.2c	R15
	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	Refer also to EN 45545-5			
Passengers and Driver HVAC System & Electric Heaters	EX5	External design features	External design features (e.g. streamlining parts, ventilation grills, flaps, skirts, coverings for HVAC systems, enclosures, etc.)	R7
	IN13	Air filters	Materials for air filters used for equipment ventilation, heating and air conditioning.	R5

	IN12A	Air ducts - Interior surfaces	Interior surface of ducts which are installed on the interior of the vehicle and from which air flows into the vehicle interior	R1
	IN12B	Air ducts - Exterior surfaces	Exterior surface of ducts which are installed on the interior of the vehicle and from which air flows into the vehicle interior	R1
	Refer also to EN 45545-5			
Traction motor & gearbox	EL1B	Cables for exterior	Cables not compliant with one of the standards referenced in 4.2c	R16
	EL7B	Choke and coils and exteriors	Chokes for supply line filtering, coils for air-cooled transformers, including spacers and air guiding plates and traction motor winding insulation	R23
Event recorder	EL9	Printed circuit boards	Printed circuit boards without any attached technical equipment	R24 or R25

(*) Exposed surfaces of a material, which form part of an assembly, shall be tested to the appropriate requirement set defined in Table 3.

Any material that is part of an assembly, but does not form part of all fire test specimens, for example because it exceeds the thickness limit of the test methods, may be separately tested to the relevant requirement(s) as defined in R17, except intermediate layers of floor assemblies which may be tested to the requirement(s) as defined in R28. This requirement is not applicable to seat upholstery assemblies (because seat assemblies are tested according to R18 and R21)

Table 3 – Materials Fire Behaviour

Any material used, even if not included in Table 3, must meet the requirements specified in chapter 4 of the EN 45545-2 standard.

5.2 Smoke opacity and toxicity

All the materials used do not emit toxic gases in such quantities as to be harmful.

The parameters taken as reference for the selection of materials, and the requirements they must meet, are described in "Table 5" of the EN 45545-2 standard with reference to the classification of the hazard level of the train and the set of requirements R(n) to which the material is associated.

6 FIRE BARRIERS

6.1 Requirement criteria

Fire barriers in railway vehicles are necessary for the protection of passengers and staff in the event of a fire on board. The standard to refer for this aspect is the EN 45545-3. It defines the minimum requirements that the fire barriers shall comply. These requirements depend on the barrier position and the train operation category.

The requirements refer to the criteria:

- "E" integrity criterion.
- "W" radiation criterion.
- "I" insulation criterion.

6.2 Minimum requirements for fire barriers

Therefore, experimental tests must be carried out for the barriers to verify that they meet the minimum requirements described in "Table 1" of the EN 45545-3 standard.

6.3 Preliminary definition of fire barriers

The fire barriers that must be guaranteed and the minimum requirements for the aforementioned will be reported here. The number indicates the time, expressed in minutes, in which in the experimental tests the barriers must show that they possess the requirement expressed.

From "Table 1" of the standard EN 45545-3 it can be deduced that the fire barriers that must necessarily be present on the vehicle are the following:

- Fire barriers between the underfloor technical cabinet containing high power electrical supply and the passenger and staff compartment, to ensure safety for passengers and staff in the event of a fire being placed in the components below the floor. Requirement: **E15**.
- Fire barriers between the technical cabinet located in the body shell containing high power electrical supply and the passenger and staff compartment, to ensure safety for passengers and staff in the event of a fire being placed in the components inside the cabinet. Requirement: **E15**.

The fire barriers should be tested according to EN 1363-1 and EN 1364-1.

7 FIRE CONTROL AND MANAGEMENT SYSTEMS

The minimum requirements in the management and control of fires with reference to the classification of the 2N vehicle provided for by the EN 45545-6 standard are indicated.

7.1 Fire detection system

Referring to table 1 of the EN 45545-6 standard (considering the classification of the vehicle 2N) it is not necessary to insert fire detection systems in any of the areas present in the train.

The standard UIC 642, chapter 6, referring to electric motive power units, establishes that all fully-enclosed compartment for electrical equipment and for motive power units controlled remotely (and also high and medium high voltage rooms) must be fitted with devices capable of detecting fire.

In case of fire detection in these cabinets, it must be signaled in all the driver's cab occupied in the train by activation of an optic and acoustic signal, and the energy supply and the ventilation in the area involved in the detection must be automatically stopped.

Thus, the following units must be provided with a detection system:

- Traction converters
- Auxiliary inverter
- MV cabinet
- HV cabinet

However, it is considered appropriate to insert a detection system also in the following rooms:

- Driver's cab
- Passenger compartment

Passenger compartments of the train set shall be equipped with a passenger warning system which allows informing the on-board personnel in case of detection of fire by a passenger. Similarly, all passenger compartments shall be equipped with a passenger warning system which will ensure transmitting the information taken from on-board personnel to the passengers.

Each driver's cab shall be equipped with a audial and visual fire alarm system integrated with Train Monitoring System (TCMS).

The system must indicate to the driver the detection of a possible fire and the place where this has been detected (passenger compartment or electrical cabinet)

7.2 Selective shut down of energy supply

In response to the alarm sent by the detection system, the energy supply of the affected area must be shut down if it belongs to the following list:

- Technical cabinet containing traction equipment

7.3 HVAC inhibition

The HVAC system must comply with the EN 45545 standard.

In particular, with reference to standard EN 45545-6, paragraph 5.4.2.3.1, the automatic shutdown of the HVAC system relating to the area affected by the detection must be guaranteed when the alarm is activated in the driver's cabin or passenger area, to prevent the fire from spreading at higher speed.

Shutdown of the HVAC unit shall be possible also manually.

7.4 Fire extinguishing media

A sufficient number of portable fire extinguisher shall be provided in the train set.

The portable fire extinguishers foreseen for the configuration have been chosen according to the fire classification according to the EN 2 standard.

According to the standard EN 45545-6, fire extinguishers must compliance the following requirements:

- The total weight of an extinguisher shall not exceed 15 kg;
- Extinguishers shall be usable when the train is operating.
- An extinguisher shall be positioned within 15 m of any place in a passenger or staff area;
- There shall be an extinguisher within 6 m from the end of the train set or a dead end;
- If a passenger or staff compartment is longer than 6m, it shall be equipped with an additional extinguisher.

Therefore, there are:

- 1 HFC 236 Fa gas portable extinguisher in each driver's cab (that according the standard UIC 642 shall be at least of 5 kg).
- 2 HFC 236 Fa gas portable extinguishers in each passenger compartment.

Required precaution shall be taken for vandalism and unauthorized usage by the passengers.

In case that the fire extinguishers in the passenger compartment are removed from their housings, buttons on these housings shall be activated automatically and an alarm notification shall be given to the driver's cabin informing that the fire extinguisher is removed.

Fire extinguishers mounted in the passenger compartment shall be equipped with a plate which says "when the fire extinguisher is removed, alarm will be activated" in Turkish and English.

Fire extinguishers must comply with the standard EN 3-7, 3-8, 3-9, 3-10.

8 EMERGENCY REQUIREMENTS

8.1 Emergency lighting

Referring to TSI LOC&PAS and the EN 45545 standard the vehicle shall be equipped with an emergency lighting system that shall meet the following requirements:

- It shall be guaranteed for a minimum operating time of 90 minutes after the main energy supply has failed.
- Lighting level shall be of at least 5 lux at floor level
- In the event of fire, the emergency lighting system shall continue to sustain at least 50 % of the emergency lighting in the vehicles not affected by fire for a minimum of 20 minutes.
- The system shall comply the requirements expressed in point 5.3 of the standard EN 13272.

8.2 Passenger emergency exits

Referring to TSI LOC&PAS and the standard EN 45545-4, emergency exits for passenger compartments shall meet the requirements:

They shall meet the following requirements:

- They shall be provided on both sides of the unit.
- At least 3 emergency exit shall be provided
- They shall be able to be opened by a passenger from inside the train
- All the emergency exits shall be indicated with visible signal
- All external passenger doors shall be considered emergency exits (according to the requirements of the standard EN 14752) and they shall be equipped with emergency opening devices allowing them to be used as emergency exits.
- Once opened, each emergency exit shall give an unobstructed opening of at least 700x550mm
- The number of the doors and their dimensions shall allow the complete evacuation within three minutes by passengers without their baggage.

For the driver's cab, the requirements that shall be met for the emergency exit are:

- The emergency exits must have a minimum free area for passage of 2000 cm² with a minimum internal dimension of 400 mm
- An emergency exit (door or window) on both sides must be ensured from the driver's cabin outside the train
- All internal doors between the driver's cabin and any adjacent area must be designed so as not to obstruct the evacuation and must be able to be opened by the staff without the need to use keys
- Emergency exits must be indicated with appropriate signs

END OF DOCUMENT