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– DELIVERABLE REPORT –

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The scope of the document applies to:

Metro systems only	Metro and Light Rail		Light Rail only
	With no differentiation	With specific adaptation(s)/recommendation(s) (1)	
		For metro	
	X		

(1) – Put a [D] if these adaptations/recommendations are present in the document and a [L] if they will have to be detailed later.

Remark by the author:

Differentiations in this document are focused on manned and unmanned driverless modes (GOA3 and GOA4) on the one hand, versus more traditional operating modes for door services on the other hand



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SECTION I – DELIVERABLE SUMMARY

Deliverable Title	
Deliverable ID , associated WP & Subproject	D51 MODACCESS / WP 14
Type of Deliverable	Design Specification
Input / Starting stage	MODTRAIN MODLINK EUPAX D7.1 (WP7 Trains HMI Doors)
Output / Final stage	Recommendation for standardization when applicable

Lead partner(s)	
Achievement to date (%)	100 %
Expected date of achievement	16/01/07
Type of exploitation	
Exploitation potential	
Protection	Patent, ...
Protection date	

IP's	Partners, (type, identification, date)
Pre-existing Know-How	EN 14752 & Operators' rule books (RATP IEF DIR 028 among others)
Exploitation Rights	

Associated Risk analysis	Type, solution envisaged, action, actors	Actual Reduction
Before start		
During task implementation	Multiple operational cultures and rules. Multiple driverless manned/unmanned/ PSD/Gates/No barriers operational solutions	Standardization possible on aspects and functions, not on rules of operations

Guidelines / definition of requirements for door systems on innovative driverless urban transport systems
<p>Deliverable Abstract This document provides requirements and guidelines related to train sidewall passenger doors on innovative driverless systems (GOA3 to GOA4). Inputs devised for other grades of automation (GOA0 to GOA2) are considered as optional including pushbutton type HMI solutions currently in use on most existing trains Specific requirements and impact analysis for driverless systems are provided (GOA3 & GOA4) Special attention was given to the needs of all types of users (standard and with reduced mobility in the wide sense of TSI-PRM). Functional (Freq) and System requirements (Sreq) are defined for the components with which passengers and staff interact at the above mentioned doors.</p> <p><u>Associated Milestone (if relevant):</u></p>

Contribution to MODURBAN Objectives as mentioned in the Description of Work



Objective Definition	Comments	Quantification
The major output expected is the reduction of varieties of ACCESS-related functionalities. (DOW p25 MODACCESS Outputs...)		
Make required “information” (in the broad sense of the word) easy to understand for everyone everywhere in Europe. Especially for the warning systems and critical situations (for example degraded modes or emergencies in the driverless public urban vehicles systems). Defining the functionality of HMI devices on board (DOW p25 MODACCESS Objectives)		
Standardizing the requirements for content and kind of information to the passenger such as: acoustic information and displayed information (format, color, language, graphic) (DOW p25 MODACCESS Objectives)		

SECTION 2 – DELIVERABLE DETAILED DESCRIPTION

General remarks

The provisions made in this document complement the actual existing standards of European level. The basic requirements are defined in EN 14752 (2006). The specific requirements in this document may be differentiating from the ergonomic findings in the MODTRAIN research project (MODLINK EUPAX WP7 “Doors” Deliverable 7.1), but nevertheless constitute the basis for those developments. In particular, section 3 is irrelevant to findings as well as to operating returns of experience on GOA3 & GOA4 operated systems.

Some recommended requirements may still stand under course of implementation on ongoing projects.

HMI relevant devices when and if applicable are well defined in EN 14752 (e.g. “finger protection”, grips in the door-leaf) and are not repeated again in this document.

The main focus of the scope of work is to address specific items related to automatic driverless unmanned & manned train operations (GOA3 & GOA4 levels of automation systems).

This document is divided in six parts:

1. General core requirements applying to whatever GOA is applicable
2. Requirements for driverless systems (attended or unattended, with and without platform screen doors). GOA3 & GOA4 systems.
3. Optional requirements for other systems (with drivers)
4. Requirements for door isolation/door out of order
5. Emergency egress devices functional and system requirements (relatively independent of previous differentiation criteria)
6. Emergency access devices functional and system requirements (relatively independent of previous differentiation criteria)

The drawings presented illustrate examples of how to devise the transfer of the requirements into physical solutions. The pictures do not describe currently specified devices of any brand.

For obstacle detection related issues, the requirements are defined in EN 14752. However currently specified values are provided herewith when applicable as examples only and not as standardization values

To optimize dwell time and platform service is an important Mass Transit concern with regard to commercial speed. Train immobilization and door opening shall be deemed simultaneous. Relevant technical considerations for this assumption to become valid do not belong to the scope of this document.



Remarks according the formulation of the requirements

The verb “**shall**” means that the requirement is to be fulfilled mandatorily.
The verb “**should**” means that it is strongly recommended to fulfill the requirement.
The verb “**will**” means that the requirement contains informational aspects (future trends).

Terms used in this document

Door

Sidewall passenger entrance door of the MODURBAN train considered

Door Isolation Device

A mechanical locking device, operable by key, provided to lock the door out of service (door isolation). This lock is additional to the door locking device for normal operation (see EN 14752 3.8).

Door Locking Device

The door locking device automatically locks the door in normal operation. (see EN 14752 3.7)

Emergency egress or access device

Device to unlock the door locking device.

Low speed signal

Train speed status signal

DCU

Door Control Unit

FREQ

Functional requirements

GOA

Grade of Automation

GOA0

On-sight train operation

GOA2

Semi-automated train operation

GOA3

Driverless train operation

GOA4

Unattended train operation



HMI

Human Machine Interface

OCC

Operations Control Centre

PA

Public Address

PED

Platform Edge Doors

PEG

Platform Edge Gates

PRM

Person with Reduced Mobility

PSD

Platform Screen Door(s)

PXSS

Passenger exchange Sub System

NOTE: includes fixed and on board equipment exchanging critical door operation info

FREQ

System requirements

TCMS

Train Control and Monitoring System

TOR

Top of rail level

TOF

Top of floor level

Remarks on Definitions used in this document

Train Control and Monitoring System (TCMS)

The TCMS operates at train-level. The TCMS either builds up or prepares or either elaborates all requirements referred to in D77 & D78 as authorization, and opening closing commands

DCU

Remark: The DCU operates in a decentralized fashion one single or a cluster of doors. The DCU controls the door-system. The DCU gets the train-level signals from the TCMS or from the brake system (speed status signal), processes them and

controls the door-system operations; the DCU sends the door status information and diagnostic information to the TCMS.

Door Locking Device

Remarks: This locking device is mostly part of the drive gear of the door; it is locked and unlocked controlled by the DCU; it also can be unlocked (“released”) by the emergency release device.

Door Isolation Device

This lock is additional to the door locking device for normal operation (see EN 14752 3.8). According to EN 14752 an isolated door can only be unlocked manually by the staff (door can’t be opened automatically, by pushbutton or emergency release device). The mechanical locking device is generally implemented along with an electrical isolation device which authorizes the door closed and locked loop to ignore the isolated door at stake

Low speed signal

Remarks: Speed defined by operator (Max. at 10km/h according TSI - max. at 5km/h acc. EN14752 - at standstill by ergonomic recommendation). The signal has only two states: high (train at speed $v \geq$ low speed signal) and low (train at speed $v <$ low speed signal). The signal has no information about the speed in km/h.

Door enabled

Definition: A door is enabled when the TCMS signal “doors enabled” is high (train side selective signal and potential other conditions mandatory to opening authorization delivery) and train-speed status signal is low speed.

Remark: An enabled door will open immediately automatically or when the doors open-pushbutton is pressed (depending on the project specific way of door operation).

Door disabled

Definition: A door is disabled when train low speed status signal is high or the TCMS signal “doors enabled” is low or both of these conditions are fulfilled.

Remarks: A disabled door stays closed.

An open door shall close automatically when the signals combine to “door disabled”.

Central door open command

TCMS signal to the local door control units (DCUs).

Remark: The central door open command causes to open all doors automatically (side selective) when train is at a slower train-speed than low speed signal and door enabled signal is high.

Standards used in this document

EN 14752

Standard on Railway applications — Door systems for rolling stock

2.1 General core requirements

Requirements shall be distinguished by the acronym FREQ for functional requirements and SREQ for system requirements (mostly design criteria)

The function called “door service” shall provide patronage in all circumstances with doors in a status that meets their requirements whether the latter be standard platform exchanges or more complex evacuations.

It therefore shall:

- Ensure opening of doors in all circumstances on the “side of service”
- Maintain doors closed on the opposite side during revenue service
- Maintain doors closed on both sides during revenue circulations, whether the latter includes occasional stops or not
- Enable (allow) the opening on the service side in case of an emergency device actuation if and only if the function emergency braking is active, and other conditions are met. Following an emergency alarm device actuation by a passenger. (Ref UITP84) a train will generally continue its journey to the next station in as much as possible. (Exceptions may occur when the train is running over preset operationally specified sections of track while exiting a station). Alarm triggering devices shall not directly stop the train neither open doors, unless automatic, driver, or OCC controls do clear such order. Any door shall normally be enabled below low speed by actuation of the emergency device except under specific conditions such as the ones mentioned here above. One should note however that this general requirement shall in all cases have to remain in a status where it can be remotely cancelled due to the existence of scenarios where access to track may represent in itself a significant source of hazard for patronage.
- The door service may be dependant upon :
 - the selection method for the side of service, i.e. manual, manual and checked, or automatic, and
 - the door opening system which may be either controlled by the passenger with assistance (pushbuttons or other devices), or either automatic opening

Supprimé : scenarii

In this document, driverless requirements listed do not include in any way consideration of pushbutton actuation by passengers.

New PRM functions/requirements are appearing continuously, (facilities, dragging detection, etc.). Their safe operational usage shall be included / retrofitted within the planned/existing operational requirements, and may impact the existing train door service logics in as much as retrofits remain possible at tolerable costs and do not seriously deteriorate the overall system reliability.

The system which ensures door service shall include:

- Doors and their opening/closing mechanisms
- The warning signaling lights and audio sounds for passengers



- The signs and control features available to the driver in the driving cab in case there is a driver, i.e. generally service side control button, opening preparation button, closing buttons
- The door control features available to
 - maintainers,
 - drivers,
 - rescue teams if applicable
- Features ensuring the various automatically controlled subordinated sub functions
- Alarm signals when the function emergency braking is active
- Fixed equipment to interface with TCMS when service requires such interfaces (GOA3 & GOA4 in particular, but not exclusively)

FREQ 2.1.1 Door opening/closing General	<ul style="list-style-type: none"> • The opening movement of the door-leaf shall be driven by a door drive mechanism (not manually) except in case of power failure or emergency operation. • Train immobilization and door opening shall be simultaneous • The closing movement of the door-leaf shall be driven by a door drive mechanism (not manually; except in case of power failure). • The initiation of the sequence to close the door shall be given automatically by the TCMS.
FREQ 2.1.2 Emergency alarm actuation intercom interface	<ul style="list-style-type: none"> • Emergency alarm devices whatever their operational features, should be (in all cases of new designs shall be) associated with two ways communication loudspeakers either with driver and/or with OCC. Naturally passengers should be attracted/instructed to talk prior to any actuation of any emergency device
FREQ 2.1.3 Reduced mobility passengers (PRM)	<ul style="list-style-type: none"> • In case one specific button is available for people enduring a reduced mobility situation to actuate the doors, it shall be mandatory to define the specific sequence of operation/inhibition of RMP/Regular buttons, and extension of automatic gap filler if applicable.

Mis en forme : Couleur de police : Automatique



<p>FREQ 2.1.4 Controls</p>	<ul style="list-style-type: none"> • Doors locked ; door closed, disabled, enabled : as per EN14752 and definitions • Delivery and acknowledgement of a signal “all doors closed and locked” both to the train and to the TCMS system for departure shall be mandatory. In case Platform Screen Doors are operated, the TCMS shall include in the sequence the signal delivery and acknowledgement “all PSDs closed and locked”. • Door enabling authorization shall be delivered by a TCMS signal (whether it be issued by control centre, platform, or driver or any combination of previous), after operationally defined conditions are met and acknowledged (train position with regard to platform, train stop precision satisfactory, etc.). Tolerances may vary according to presence of doors/Gates on platforms and various operationally set objectives such as quality of service
<p>FREQ 2.1.5 Door closing Obstacle detection</p>	<ul style="list-style-type: none"> • Obstacle detection inputs shall govern safety in door closing sequences. Obstacle detection tolerances are defined by national regional safety operating rules, and no door system shall be considered as closed and locked as long as any obstacle is detected.
<p>FREQ 2.1.6 Controls Low speed inputs</p>	<ul style="list-style-type: none"> • Low speed signal shall be a requirement for doors enabling. Low speed shall be physically defined both by technology limits and by operator’s prescriptions
<p>FREQ 2.1.7 Door closing Controls</p>	<ul style="list-style-type: none"> • Door closing procedures shall involve warning messages of different single or combined natures (visual signal if applicable but at least audio in all cases) dispatched towards patronage prior to the closing movement being initiated. It shall be performed under obstacle/sensing detection safety devices the status of which shall be able to trigger a door free status during an operationally specified lapse of time. Subsequent sequences of action shall depend on actions initiated (TCMS and/or OCC and /or driver) after the incident has happened.
<p>FREQ 2.1.8 PA interface Controls</p>	<ul style="list-style-type: none"> • Train information to passengers shall interface with the train door subsystem. Side of opening/closing display, warning systems of imminent action by visual and audio means. Announcements by train PA systems shall also have to be implemented.
<p>FREQ 2.1.9 Failure modes</p>	<ul style="list-style-type: none"> • Failure modes shall have to be addressed for safe operation at least until operational replacement train has been made available: <ul style="list-style-type: none"> ○ Non opening of one door may be treated by door systematic isolation lock, and service needs transfers to other doors , ○ Non automatic closing of one door shall be preventing departure in all cases and may be preventing further usage of the train in revenue operation. Depending on operating regulations, trains may be able to operate after the door has been isolated and locked by operational



	<p>emergency action by staff or driver himself</p> <ul style="list-style-type: none"> Any door failure or emergency handle actuation coming from initially unknown and/or unidentified passenger action or location shall have to be quickly identifiable and spotted for action by staff in charge
FREQ 2.1.10 Failure modes patronage interfaces	<ul style="list-style-type: none"> Passenger devices for emergency situations: In case of possible emergency handle actuation, passengers should first establish communication with the driver or OCC, then actuate the emergency handle as a last resort. The general trend should be (for new designs shall be) to allow the following sequence of events to happen via bidirectional intercom facilities: first explain to staff in charge, second follow their instructions. Clear usage instructions should (for new designs shall) be displayed at the same time Activation of train stop sequences & door opening sequences are more and more centrally monitored. While door opening still does remain conditional to local situations (ie : stop precision preventing door opening when train is not well docked), train interfaces should allow central control action first and in last resort local action by staff, but definitely a bidirectional intercom facility (ies) between and with all staff in charge and the OCC is required.
FREQ 2.1.11 Failure modes staff	<ul style="list-style-type: none"> Staff possible actions - Interior/exterior on any door <ul style="list-style-type: none"> Door locking and isolation Driving cab controls by driver if applicable Local re initiation of the emergency handle Identification of doors trough indication lights on the car body exterior
. System Overall Requirements	
SREQ 2.1.1 Door closure	<ul style="list-style-type: none"> The acoustic “door enabled” signal should be of constant volume, of one constant single frequency between (typically between 1,2kHz and 1,4kHz) and should last for at least 1 sec when door is enabled. It should be emitted at each door location in each car.
SREQ 2.1.2 Door closure	<ul style="list-style-type: none"> The acoustic signals should have a noise pressure level determined according DIN 45641 (typically between 50 Db (A) and 70Db (A) in a distance of 1 m). The acoustic signals will have a self-adjusting noise pressure level with at least 10 Db above surrounding noise level in a

Mis en forme : Anglais (États-Unis)



	distance of 1 m determined according DIN 45641.
SREQ 2.1.3 Door closure	<ul style="list-style-type: none"> • Door leaf (simultaneous leaves) actuation on closure is driven by a door drive mechanism and satisfies conditions of longitudinal effort trial, time, squeezing effort, etc., which have to be defined by the End User in the procurement contract.
SREQ 2.1.4 Door closure	<ul style="list-style-type: none"> • A door shall be deemed checked closed when the gap between the two leaves is smaller than the smallest value corresponding to obstacle detection minimum as required in EN14752.
SREQ 2.1.5 Door closure	<ul style="list-style-type: none"> • A properly closed and locked door has to withstand at least a force of 120daN in direction of opening movement without any damage done to the locking mechanism.
SREQ 2.1.6 Door geometry and kinematics	<ul style="list-style-type: none"> • The opening and closure trajectories are controlled by a guiding strip which should not be sensitive to debris and trash. Door leaves protection allow limiting the shocks. Door movement protection for patronage is dealt with in chapter 3 where pushbuttons are considered. Single door actuation devices (emergency) must not be subject to vandalism offenses, neither to weather effects • When doors do follow curved trajectories their position when checked closed shall be in full continuity with the surrounding car body shell. • Closed doors shall protect passengers from weather and audio Potential aggressive impacts. • Doors closed should be able to endure waterproof testing levels allowing processing of trains under washing machines
SREQ 2.1.7 Doors reliability, availability	<ul style="list-style-type: none"> • Door failures are critical events. They should be able to comply with the operator's MTBF requirements for critical failures able to induce unwanted dwell times. • The probability of occurrence of obtaining a door checked closed signal must be smaller or equal to a value specified by the operator • Doors should be able to operate under critical weather conditions as defined locally
SREQ 2.1.8 Vandalism	<ul style="list-style-type: none"> • Preset logs of vandalism & crime history and related events may push the Operator & Maintainer to use given vandal proof materials or items the specific nature of which shall have to be taken care of at the design stage



2.2 Specific Requirements for manned (GOA3) & unmanned (GOA4) driverless systems

- **Dwell times :**

Mass Transit requirements imply low dwell times, e.g. shorter than 30 seconds average being 15 seconds. Train and platform doors actuations should remain as much concurrent as possible (If two seconds are used to open and another 3 to close, the remaining 'useful time' is reduced an average 30%). Because a reasonable train service implies that patrons get out of train thereby freeing space for entering customers, it is relatively inconvenient if not unsafe to have PSD open after train door is fully open.

- **Platform equipment:**

Traditionally, the presence of a driver in the train did allow most operators to envisage possibility for this employee to try and cope with any emergency situation occurring from the track (with the then possible anticipation capability depending on distance of train to obstacle to be protected on the track).

In case of driverless systems, it should be mandatory in either manned and/or unmanned systems to either forbid track access, or detect unwanted presence on the track.

- *Platform screen doors systems (or platform edge doors, most of the difference coming from air conditioning and cost optimization strategies), and/or platform gates have been put into service over European driverless systems.*
- *Some other systems (Nuremberg, Lyons) have introduced virtual systems for detection of intrusions into the track from the platform.*

- **Emergencies**

Evacuation procedures principles: walkways all over the track, no walkway, detrainment doors, ladder(s). Obviously local operators (trains rescue teams should be able to have full control of doors actuations as a whole in case of emergency so as to be able to safely implement the requested procedures

- **General considerations**

The majority of options available to the Operator/Authority with impacts and consequences on door systems designs and operating principles, has been detailed hereafter. Because regulations (both national and local) do differ according to cultures and places, different solutions have been brought to the same issues, thereby making it difficult, ambitious and unproductive to produce a standard without further levels of consensus. At this stage, the only sensible attitude is to try and standardize all safety and operational guidelines or requirements, for door service and control interfaces. We insist on the fact that communication with patronage, signs and audio messages are probably the easiest parts for standardization, the rest of which is contingent upon operational cultures, habits, needs, expertise, and above all consensus.

FREQ 2.2.01 Door PXSS (Passenger	<ul style="list-style-type: none"> ○ • MODURBAN system Interface (Report to WP 21 & 22) :
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<p>exchange Subsystem)</p>	<ul style="list-style-type: none"> • The interface between the train and the platform is significantly impacted. The logical sequence of door opening/closing introduces additional conditions to be verified in the logical AND allowing orders to be carried out by TCMS. • The train positioning in the platform shall have a precision as per chapter 2.2.05. • If applicable on PSD/TD solutions, the door operation sequences by patronage incur substantial safety/availability requirements such as an inhibited use of pushbuttons and automatic opening. L13 (GOA2) in Paris is in this case where passengers of the MF 77 stock do operate enabled doors via pushbuttons on standard stations and when in stations equipped with platform edge equipment do have to be serviced by automatic systematic door opening and inhibition of pushbutton actuation. • Until such time communications between a single train door and its regular opposite platform screen door is feasible in a quick, fail safe, and reliable fashion it shall be recommended but not limited exhaustively to in particular: <ol style="list-style-type: none"> 1. Inhibit door pushbutton systems on any equipped train for platform screen doors equipped platform screen doors non platform screen doors situations on the same line 2. Operate without pushbuttons on newly built systems 3. Open and close the same number of platform screen doors and train doors 4. Design fully intercommunicating trains (shuttles) so as to be able to meet safety evacuation procedures in case of train door/platform door isolation situations
<p>FREQ 2.2.02 Emergency</p>	<ul style="list-style-type: none"> • On board staff presence on driverless systems can be permanent or occasional <ul style="list-style-type: none"> ○ In case of driverless manned systems, the operator shall have an option for all emergency actions relevant to doors to be partially done by on board staff (door isolation, patronage information interface, alarm reporting etc.) ○ In case of driverless unmanned systems, all interface situations do take place at least in a first phase between control centre and patronage, which does imply presence of adequate intercom equipment (bidirectional intercom) and a specific emergency handle actuation response, until such time the rescue roving teams come on site



FREQ 2.2.03 No pushbuttons/ pushbuttons inhibited	<ul style="list-style-type: none"> In case of physical station barrier (platform screens or any other system in one single (or a cluster of) station(s) out of all the stations on the line, pushbuttons equipping train doors (if applicable) shall have to be turned fail safely inactive on the specific opportunity.
FREQ 2.2.04 PXSS	<ul style="list-style-type: none"> Train doors actuation mechanisms adjustments shall always respect constraints of screen doors simultaneous operation, in order to minimize station dwell time, and facilitate safe transfers of patronage
FREQ 2.2.05 Controls/geometry	<ul style="list-style-type: none"> Train berthing accuracy shall be mandatory to a pre specified tolerance : relative widths PSD/Train doors : <ul style="list-style-type: none"> PSDs/PEDs/PEGs shall have wider dimensions than train double leaf door widths so as to tolerate stopping accuracy variations without encountering an abnormal situation requiring time consuming procedural developments
FREQ 2.2.06 Emergency	<ul style="list-style-type: none"> Station staff action on incidents. <ul style="list-style-type: none"> Train door incidents in case of PSD equipped platform may be dealt with by station staff (door isolation etc.)
FREQ 2.2.07 No Actuation devices/ pushbuttons inhibited	<ul style="list-style-type: none"> Door actuation devices shall be avoided on new systems and substantially modified on PSD retrofit situations involving existing pre equipped trains.
FREQ 2.2.08 Emergency	<ul style="list-style-type: none"> Emergency handle re-initialisation shall always remain possible in a given train by staff. Nevertheless capability from OCC or central control external point shall be mandatory. In particular in unmanned situations the Operator might judge a distant control to be more appropriate under the relevant procedures Because in some cases it might be dangerous to have one single type of reaction to a completely different sequence of events, management of the emergency situations signaled by patronage should definitely be split in two separate phases. <ul style="list-style-type: none"> First one is for passengers to inform staff in charge. Second one is for passengers to follow the instructions they have given. Activation of an alarm device shall be a necessary condition for door enablement by passengers, but such enablement shall only be effective with fail safe controls initiated by governing staff in charge (who are the only ones in a position to fully assess what has to be done). Therefore : <ul style="list-style-type: none"> Driverless systems door operation should be observable door by door by the operations supervisor in charge in the OCC.



FREQ 2.2.09 Emergency	<ul style="list-style-type: none"> Emergency handle shall be able to be inhibited in different cases (opposite to emergency egress path in tunnel, opposite to platform in station if needed for example).
FREQ 2.2.10 emergency	<p>Door management options on departures:</p> <ul style="list-style-type: none"> When train is departing and emergency handle is activated, UITP 84 shall in all cases specify and clearly address all unsafe possibilities.
FREQ 2.2.11 Emergency	<ul style="list-style-type: none"> Door operation alarms should first be reported to OCC for failure & emergency mode activation(s) if and when deemed appropriate by field staff
FREQ 2.2.12 Train physical outlay	<ul style="list-style-type: none"> Train intercommunication (continuous gangway inside shuttle units) shall be installed on driverless unmanned systems (GOA4). On manned systems (GOA3), as one person per shuttle is present on board several shuttles can form a train consist. These operating requirements definitely impact who is doing what in case doors are to be isolated as well as passenger communication procedures
FREQ 2.2.13 Train system	<ul style="list-style-type: none"> In case somebody escapes on the track or track is deemed occupied by alarm from an intrusion detection system, responses may differ according to the power supply system. <ul style="list-style-type: none"> Stop operations for safety reasons (power off in case of third rail, emergency braking on approaching trains). Operations may resume (power supply on with overhead wire equipment) The type of response may impact conditions for emergency door opening on berthed trains
FREQ 2.2.14 Network policies	<ul style="list-style-type: none"> Standardize codes and usage as much as possible between different modes. This standardization requirement principally bears on signage colors and tones on the same network, when not all the lines are driverless



2.3 Requirements for other systems

(This part of the work is optional when considered in light of the main focus to the document. It is however highly important for most systems in operation under GOAs differing from 3 & 4 which represent the vast majority).

2.3.1. Requirements for HMI to open door (Optional for information only as per conclusions of Sept 2005 meeting in Berlin)

Using traditional lever opening devices and/or pushbuttons implies additional haptic considerations and specific operational requirements. These requirements focus on the door open pushbutton if deemed applicable (pushbutton may not exist on automatic trains or if always all doors of one train-side are opened simultaneously see chapter 2.2).

In case the infrastructure includes platform screen doors for train door service, then there is normally no need for pushbuttons identified.

In case train doors are fitted with in pushbuttons, these latter should normally remain active in all circumstances. It is not advised to proceed to activation and deactivation of such buttons during the same service. Only exceptional purely transitional situations can be managed this way when no other means do exist. Meanwhile, when this is in application, information and messages do constitute the backbone of patronage security

Supprimé : citcumstances

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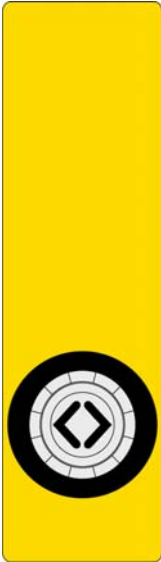
2.3.1.1 Functional Requirements - HMI to open sidewall passenger door



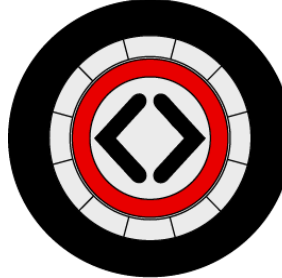

FREQ 2.3.1.1.01	The initiation to open the door shall be given automatically or manual by pressing an "open pushbutton"
FREQ 2.3.1.1.02	The driven door opening movement shall be controlled in a safe manner according EN14752 ("finger protection")
FREQ 2.3.1.1.03	The pushbutton shall be located at an ergonomic position
FREQ 2.3.1.1.04	The pushbutton shall be found easily by all people (passenger, crew, disabled persons according TSI-PRM.)
FREQ 2.3.1.1.05	The pushbutton shall be designed to be activated easily by all people
FREQ 2.3.1.1.06	The pushbutton shall provide relevant door status information for all people
FREQ 2.3.1.1.07	The pushbutton shall provide response for all people when pressed
FREQ 2.3.1.1.08	The enabled closed door and also open door shall be indicated to disabled persons
FREQ 2.3.1.1.09	Passenger doors for wheelchair users shall be equipped with an additional internal and an additional external pushbutton at ergonomic position



2.3.1.2 System Requirements - HMI to open sidewall passenger door

	1. HMI to enable door opening
SREQ 2.3.1.2.01	Each door shall be equipped with an external open push-button
SREQ 2.3.1.2.02	Each door shall be equipped with an internal open push-button
	2. Location of the open pushbutton
SREQ 2.3.1.2.03	On single panel doors the pushbutton shall be located near the leading edge of the door (on the door-panel or on the sidewall or its cover)
SREQ 2.3.1.2.04	On double panel doors the pushbutton shall be located on the door panel near the leading edge of one door-leaf
SREQ 2.3.1.2.05	The external pushbutton shall be mounted at 1750mm ±30mm TOR for the new and empty car (= 990mm for 760mm-platform, 1200mm for 550mm platform). The external pushbutton shall be mounted at 1100mm ±30mm TOF if the platform level is equal to the cars floor level (often at metro systems)
SREQ 2.3.1.2.06	The internal pushbutton shall be mounted at 1100mm ±30mm TOF
SREQ 2.3.1.2.07	Additional pushbuttons for wheelchair users shall be mounted at about 0, 85 m above platform level respectively floor level of the car.
	3. Dimensions of the activation area
SREQ 2.3.1.2.08	The activation area which is sensitive to inputs should have at least a diameter of 40mm
SREQ 2.3.1.2.09	The activation area which is sensitive to inputs should protrude typically 3mm above the surrounding area of the button and should prevent unintended actuation.
	4. Appearance of the pushbutton and its surrounding
SREQ 2.3.1.2.10	The pushbutton shall provide protruded (raised) haptic information by means of raised "open" symbol.
SREQ 2.3.1.2.11	The external pushbutton shall be surrounded by a contrast strip, which is at least as wide as the pushbutton diameter and reaches at least 250 mm above and 100 mm below the pushbutton. (See also picture 2.3.1.2.A)
SREQ 2.3.1.2.12	The contrast strip should be in a strong contrasting color to its adjacent area.
SREQ 2.3.1.2.13	The contrast strip will contain haptic information by means of a rough surface.

<p>Picture 2.3.1.2..A</p>	<p>Symbol picture of the contrasting strip:</p>  <p><i>The picture does not describe currently existing devices of any brand</i></p>
<p>SREQ 2.3.1.2.14</p>	<p>The outer ring of the pushbutton should be green respectively blue for the wheelchair users pushbutton</p>
<p>SREQ 2.3.1.2.15</p>	<p>The pushbutton should not protrude more than 10 mm above the surrounding area of the pushbutton unless agreed otherwise.</p>
<p>5. Haptic informations & activation forces</p>	
<p>SREQ 2.3.1.2.16</p>	<p>The force required to actuate the pushbutton shall be >3N and ≤ 10 N.</p>
<p>SREQ 2.3.1.2.17</p>	<p>The pushbutton should provide the protruded haptic symbol with a height of at least 1mm.</p>
<p>SREQ 2.3.1.2.18</p>	<p>The pushbutton should provide haptic feedback when actuated successfully (at least 1mm of travel or vibration response).</p>
<p>6. Optical signals</p>	
<p>SREQ 2.3.1.2.19</p>	<p>The green signal-lights of the pushbutton shall be similar RAL 6032. The red signal-lights of the pushbutton shall be similar RAL 3020.</p>

<p>SREQ 2.3.1.2.20</p>	<p>If the door is enabled the pushbutton shall show constant green light (approximately 50% of the available green lights recommended)</p> <p><i>The picture does not describe currently existing devices of any brand</i></p>	
<p>SREQ 2.3.1.2.21</p>	<p>During opening movement of the door-leaf the pushbutton should provide blinking green lights (100% of available green lights blinking at a frequency of about 5Hz)</p>	
<p>SREQ 2.3.1.2.22</p>	<p>An accepted input (pushbutton pressed and door is enabled) should be indicated with all existing green lights constantly illuminated for 1 sec respectively as long as the pushbutton is pressed</p> <p><i>The picture does not describe currently existing devices of any brand</i></p>	
<p>SREQ 2.3.1.2.23</p>	<p>Not accepted input (door not enabled, wrong car side, ...) should be indicated with constant red light (100% of available red lights) for at least 1 sec or as long as the pushbutton is pressed</p> <p><i>The picture does not describe currently existing devices of any brand</i></p>	
<p>SREQ 2.3.1.2.24</p>	<p>Door in service, but not enabled should be indicated with no light (all lights of the pushbutton off).</p> <p><i>The picture does not describe currently existing devices of any brand</i></p>	
<p>SREQ 2.3.1.2.25</p>	<p>The red lights will be placed at a different diameter or different area than the green lights (for red / green disabled persons)</p>	



SREQ 2.3.1.2.26	The illuminated red and green areas shall have a minimum luminous intensity of 30 cd/m ²
SREQ 2.3.1.2.27	The illuminated red and green areas should have a maximum luminous intensity of 100 cd/m ²
SREQ 2.3.1.2.28	Starting remote controlled open movement of the door-leaf should be indicated with 50% of the green lights in the pushbutton, blinking as alarm signal, starting when movement starts

2.3.2 Requirements HMI to close door (Optional for information only as per conclusions of Sept 2005 meeting in Berlin)

These requirements define the HMI of the door close function in case some pushbuttons are specified.

2.3.2.1 Functional Requirements - HMI to close sidewall passenger door

FREQ 2.3.2.1.01	The driven door closing movement shall be controlled in a safe manner according EN14752 ("finger protection")
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2.3.2.2 System Requirements - HMI to close sidewall passenger door

SREQ 2.3.2.2.01	The acoustic "door closing" alarm signal should be a beeping signal of a frequency of 1,2kHz and 700Hz, a clock frequency of 3Hz and a pulse sequence of approx. 1:1. The signal should start 2 sec before door panel starts moving.
SREQ 2.3.2.2.02	The acoustic door close alarm should be generated over the middle position of the open door
SREQ 2.3.2.2.03	The acoustic signals should have a noise pressure level between 50 dB (A) and 70dB (A) in a distance of 1 m determined according DIN 45641. The acoustic signals will have a self-adjusting noise pressure level with at least 10 dB above surrounding noise level in a distance of 1 m determined according DIN 45641.
SREQ 2.3.2.2.04	If a close button function is required by the operator, the above defined door open pushbutton should take over the close pushbutton function when the door-leaf is at open position. (same optical and acoustical signals as defined above)


2.4. Requirements HMI door isolation / door out of order

Applicable in most situations, including in situation 2.1 and 2.2

2.4.1 Functional Requirements - HMI to isolate sidewall passenger door

FREQ 2.4.1.01	Each door has to be equipped with a mechanical isolation device which can't be operated by the passenger. Respectively the whole car has to be evacuated and isolated / deactivated in case of a door failure.
FREQ 2.4.1.02	The isolation device shall indicate the state of isolation ("isolated" / "not isolated") for the staff (needs not to be obvious to the passenger)
FREQ 2.4.1.03	The isolation device shall be operable only in door closed position to avoid erroneous operation.

2.4.2 System Requirements - HMI to open sidewall passenger door

SREQ 2.4.2.01	The isolation device shall be operated by means of the RIC square (or alternate geometrical section) key as defined in EN 14752 (the key shall also be available at rescue forces!).	Mis en forme : Couleur de police : Automatique
SREQ 2.4.2.02	The isolation device shall be capable to withstand all operational forces in case of a defective door locking mechanism. The location and protection of such device shall be discrete and vandal proof	Mis en forme : Couleur de police : Automatique
SREQ 2.4.2.03	The isolation device should be operable from outside and inside of the car.	
SREQ 2.4.2.04	The isolation device should remotely be operable for driverless trains. Successful (safe) isolation shall be signaled.	
SREQ2.4.2.05	Door out of order (deactivated, cut out or no power supply) shall be indicated inside and outside with adhesive tape applied over the pushbuttons and a sheet with written text and a door out of order symbol in the door-window(s).	
SREQ 2.4.2.06	In case of pushbutton, door out of order (isolated, deactivated or no power supply) shall be indicated at the pushbutton with no lights and with no acoustic signal <i>The picture does not describe currently existing devices of any brand</i> In all other cases a specific indication shall be provided	
SREQ 2.4.2.07	If the door is isolated remotely on driverless systems it has to be indicated immediately with an illuminated sign at the door-leaf with the text "door out of order" in the language of the country.	
SREQ 2.4.2.08	The illuminated sign at the door-leaf should be placed above the open pushbutton (Center approx. 1650mm TOF / 1650mm TOR) if applicable.	Mis en forme : Couleur de police : Automatique



2.5. Requirements HMI emergency egress device

Applicable in most situations, including in situation 2.1 and 2.2

2.5.1 Functional Requirements - HMI of emergency egress device+

FREQ 2.5.1.01	The emergency egress device shall be found easily by all people (passenger, crew, disabled persons,) and shall be located at an ergonomic position at each sidewall door.
FREQ 2.5.1.02	The emergency egress device shall be seen under bad light conditions (smoke, power failure in nighttime, crash scenarios, ...)
FREQ 2.5.1.03	The emergency egress device shall release the door lock without any other power or tools than manual force when train is at speed lower than v1 unless other specific conditions are explicitly specified and agreed upon between the operator, the car builder and the authorities.
FREQ 2.5.1.04	In case of a power failure the door lock release function of emergency egress device shall be available without restriction (except door is isolated) unless other specific conditions are explicitly specified and agreed upon between the operator, the car builder and the authorities.
FREQ 2.5.1.05	For the needs of emergency case communication with the driver or the OCC, each door shall be equipped with a nearby situated device.
FREQ 2.5.1.06	The emergency egress device shall be designed to allow an easy activation for all people (also disabled persons).
FREQ 2.5.1.07	For the staff it shall be obvious at which door the emergency egress device is activated.
FREQ 2.5.1.08	The emergency egress device shall be protected against easy misuse.
FREQ 2.5.1.09	The emergency egress device shall be actuated with its handle - no additional emergency device has to be activated (before, during or after using the emergency handle).



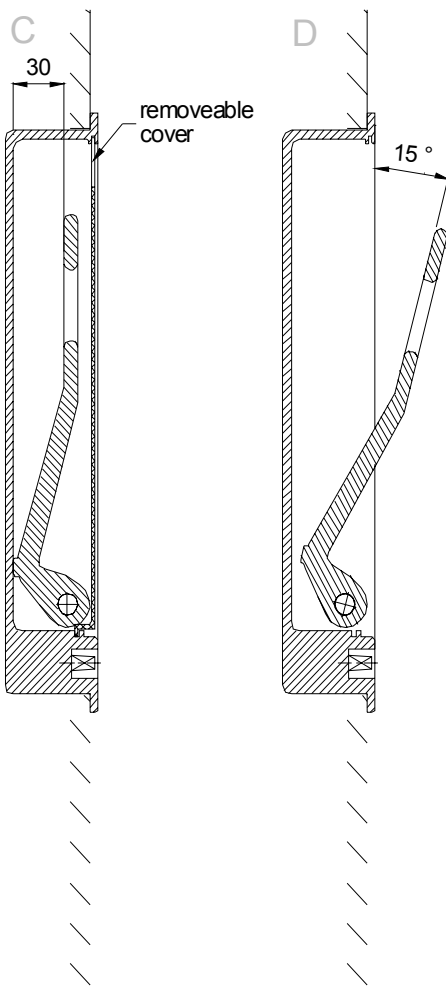
2.5.2 System Requirements - HMI of emergency egress device

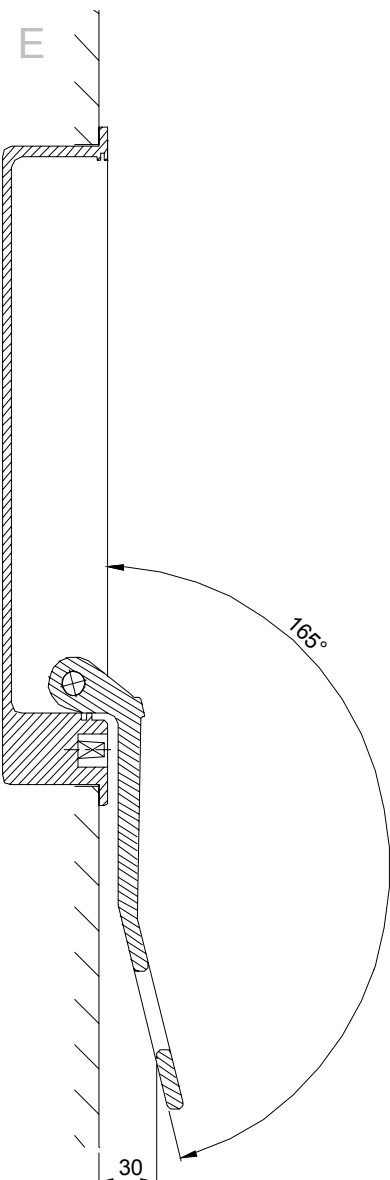
	1. Location
SREQ 2.5.2.01	The emergency egress device shall be mounted adjacent to the entrance as shown in prEN14752
SREQ 2.5.2.02	The emergency egress device will not be part of the door-leave
SREQ 2.5.2.03	The front surface of the emergency egress device should be parallel to the door-leave (seen frontal in emergency exit direction)
SREQ 2.5.2.04	The center of the grip-area of the handle of the emergency egress device shall be 1500mm TOF (± 25 mm)
	2. Dimensions
SREQ 2.5.2.05	The length of the handle of the emergency egress device will depend on the door locking mechanism principle
SREQ 2.5.2.06	The grip-area of the handle shall be designed to allow a grip of 360° with the fingers and shall have a cut-out width of at least 80mm (
	3. Appearance
SREQ 2.5.2.07	The color of the emergency egress handle shall be green RAL 6032 (see picture 4.A figure A)
SREQ 2.5.2.08	The handle of the emergency egress device should be covered by a breakable cover
SREQ 2.5.2.09	The breakable cover of the emergency egress device should be of transparent material if covering a large area of the handle. If not transparent it should be marked with the same red arrow as the handle.
SREQ 2.5.2.10	The emergency egress and access device shall be surrounded by a luminescent marking of a width of at least 15mm
SREQ 2.5.2.11	A green continuous fluorescent vertical marking strip (min. 30mm wide) should lead from floor (0 mm TOF) to the emergency egress device
SREQ 2.5.2.12	The emergency egress device shall be in high color contrast to the adjacent area

<p>Picture 2 5.A</p>	<p>Picture of the appearance and minimum dimensions of the handle</p> <p>The picture does not describe currently existing devices of any brand</p>
<p>4. Activation & forces</p>	
<p>SREQ 2.5.2.13</p>	<p>The breakable cover of the emergency egress device shall break when applying a force of max. 150N on an area of max. 25cm² or be removed when pulling with a force of maximum 150N.</p>
<p>SREQ 2.5.2.14</p>	<p>For the staff the cover of the handle of the emergency egress device should be removable without breaking by turning the key-lock clockwise 90°</p>



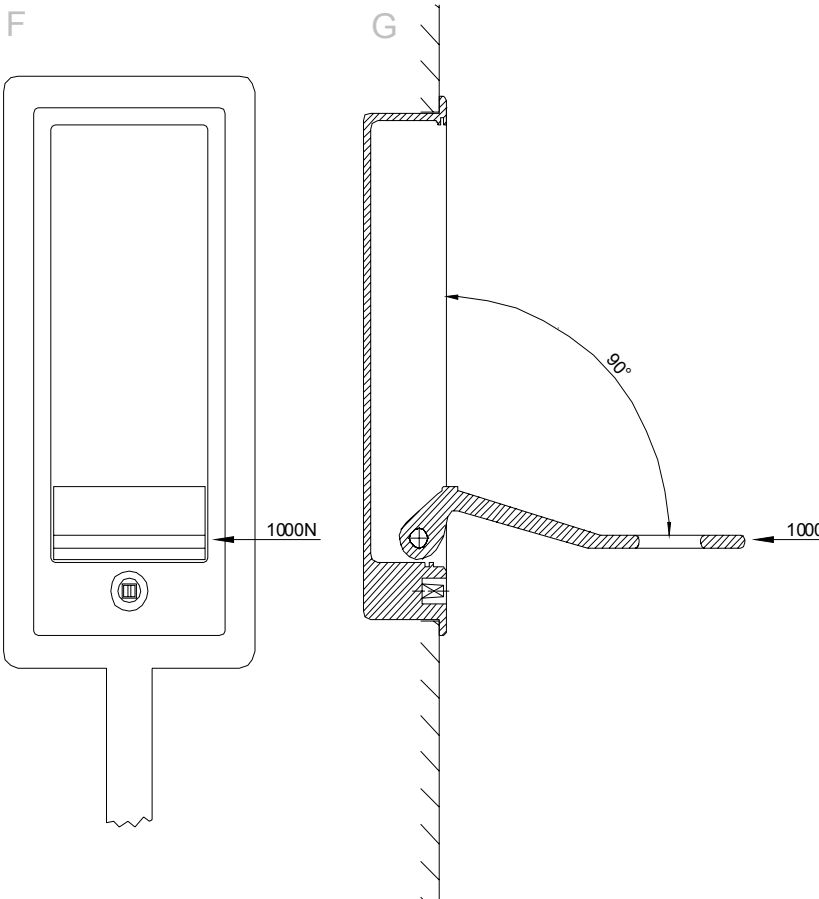
SREQ 2.5.2.15	The handle of the emergency egress device shall be a pull down handle
SREQ 2.5.2.16	The inactivated position of the handle of the emergency egress device will be the 0° position (see picture 4.B figure C)
SREQ 2.5.2.17	The handle of the emergency egress device should return to 0° (not) activated position and trigger no function if actuation of handle is less than 15°
SREQ 2.5.2.18	The handle of the emergency egress device should rest in 15° activated position if activation is incomplete (less than 100%)
SREQ 2.5.2.19	The 100% door lock release will be before 165° activation angle of the handle of the emergency egress device

<p>Picture 2 5.B</p>	<p>Picture of inactivated handle position and 15° handle position</p>  <p>The picture does not describe currently existing devices of any brand</p>
<p>SREQ 2.5.2.20</p>	<p>The 100% activated position of the handle of the emergency egress device will be limited by a mechanical stop that keeps a free space between the grip of the handle and the sidewall of at least 30mm</p>

<p>Picture2 5.C</p>	<p>Picture of handle position 165° (device fully activated)</p>  <p>The picture does not describe currently existing devices of any brand</p>
<p>SREQ 2.5.2.21</p>	<p>The maximum activation force of the handle of the emergency egress device between 0° and 15° shall be less or equal 150N tangent to its rotational movement.</p>
<p>SREQ 2.5.2.22</p>	<p>The maximum activation force of the handle of the emergency egress device between 15° and 100% activation shall be less or equal 150N in direction of movement when emergency egress device is enabled (speed slower v1 or no power supply of door-system available)</p>

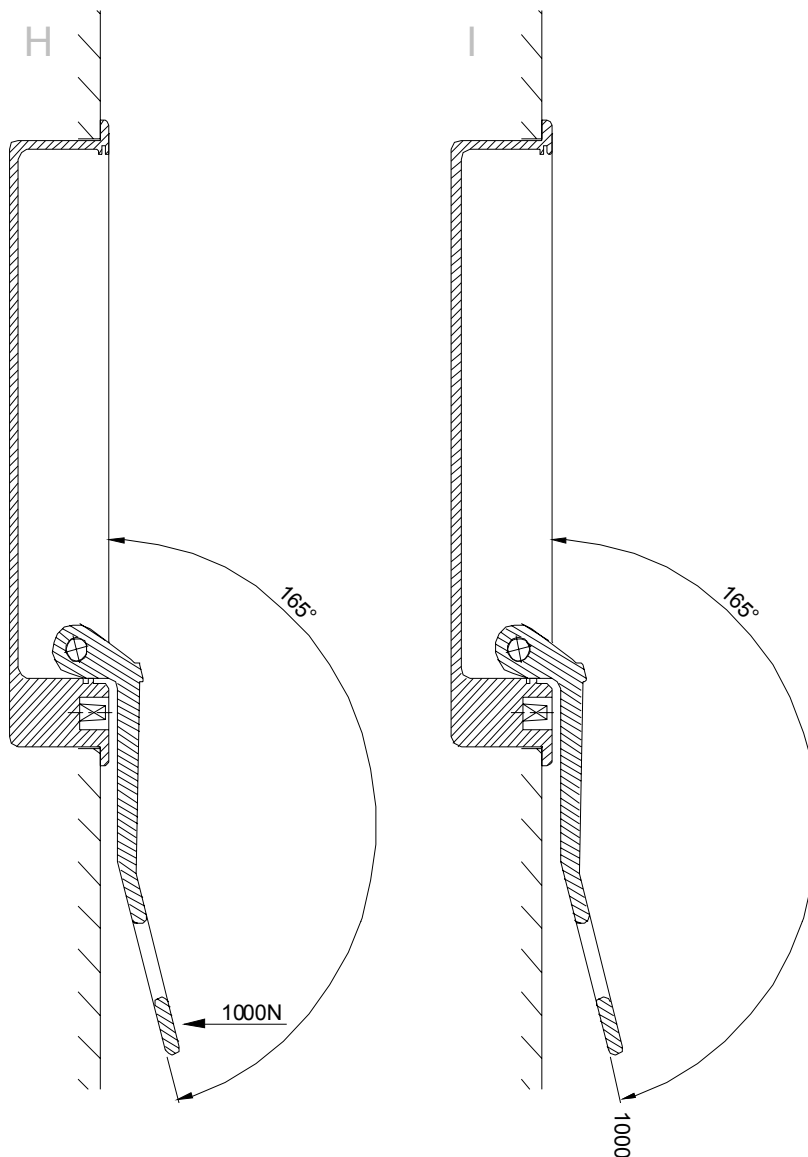


SREQ 2.5.2.23	The maximum activation force of the handle of the emergency egress device between 15° and 100% activation shall be less or equal 50N in direction of movement when emergency egress device is disabled (train speed higher than v1 and power supply of door-system available) (door shall not be released under this condition!)
SREQ 2.5.2.24	A unsuccessful release of the door lock with the emergency egress device caused train speed higher than v1 shall require a second activation of the handle to 100% activated position when train speed is slower than v1
SREQ 2.5.2.25	An activated emergency egress device should not be completely reset-able by the passenger (will stop in 15° position after activation)
SREQ 2.5.2.26	The emergency egress device should be set back in not activated position by staff by turning the square-key-lock counter-clockwise 90°
5. Information & signals	
SREQ 2.5.2.27	If the handle of the emergency egress device is pulled for at least 15° the acoustic "emergency egress device activated" alarm signal should appear
SREQ 2.5.2.28	The acoustic emergency egress device activation signal should be a continuous tone of constant volume and a frequency between 1,2kHz to 1,5kHz and should be emitted over the center of the open door.
SREQ 2.5.2.29	The acoustic emergency egress device activation signal should have a noise pressure level of 75dB (A) in a distance of 1 m determined according DIN 45641. The acoustic emergency egress device activation signal will have a self-adjusting noise pressure level with at least 15 dB above surrounding noise level in a distance of 1 m determined according DIN 45641.
SREQ 2.5.2.30	An activation of the emergency egress device of 15° shall automatically activate a voice communication to the driver
6. Miscellaneous	
SREQ 2.5.2.31	The transmission between emergency egress device and the door locking device shall consists of a mechanical transmission only (e.g. Bowden cable; not depending on supply energy, pressure transmission and so on)
SREQ 2.5.2.32	The actuation of the emergency egress device will not move the door leaves exceptionally at sliding doors without additional grip on the outside of the door leave to open it
SREQ 2.5.2.33	The handle of the emergency egress device will withstand a vertical force of 1,0 kN spread over the width of the grip when at 100% activated position (vandalism resistance)
SREQ 2.5.2.34	The handle of the emergency egress device will withstand a force of 1,0 kN from any horizontal direction spread over at least 2cm² at 90° activated position (vandalism resistance)

<p>Picture 2 5.D</p>	<p>Picture 1 of 2 of vandalism forces</p>  <p>The picture does not describe currently existing devices of any brand</p>
<p>SREQ 2.5.2.35</p>	<p>The use and functions of the emergency egress device should be shown in an info sheet at each seat of the car (safety information concept similar as in airplanes).</p>
<p>SREQ 2.5.2.36</p>	<p>The forces for activation of emergency egress device shall be measured at an external and internal temperature between -25°C and +100°C</p>
<p>SREQ 2.5.2.37</p>	<p>The breakable cover of the emergency egress device shall not hurt when broken</p>

Picture 2 of 2 of vandalism forces

Picture2 5.E



The picture does not describe currently existing devices of any brand.

SREQ 2.5.2.38

No other emergency device shall be mounted near the entrance than the emergency egress device to avoid loss of time and confusion in case of an emergency.



2.6. Requirements HMI emergency access device

2.6.1 Functional Requirements - HMI of emergency access device

FREQ 2.6.1.01	The emergency access device shall be marked in a contrasting color to its adjacent area to be found easily by crew and rescue forces under bad light conditions (smoke, power failure in nighttime, crash scenarios, ...)
FREQ 2.6.1.02	Each car shall be equipped with at least one emergency access device per side of car, located at an ergonomic position from track level and from platform height for operation by staff and rescue forces
FREQ 2.6.1.03	The emergency access device shall release the door lock without any other power or tools than manual force under any condition except the door is isolated
FREQ 2.6.1.04	The emergency access device shall be protected against misuse by not authorized persons by a locked cover which can be unlocked with a RIC square key
FREQ 2.6.1.05	The cover of the emergency access device shall protect the handle against extensive dirt or ice



2.6.2 System Requirements - HMI of emergency access device

	1. Location
SREQ 2.6.2.01	The emergency access device shall be mounted adjacent to the entrance as shown in prEN14752
SREQ 2.6.2.02	The emergency access device will not be part of the door leave
SREQ 2.6.2.03	The front surface of the emergency access device should be parallel to the door panel (seen frontal in emergency ingress direction)
SREQ 2.6.2.04	The center of the grip area of the handle of the emergency access device shall be between 1200mm and 1500mm TOR
SREQ 2.6.2.05	The handle of the emergency access device shall be orientated horizontally (horizontal activation way of handle).
	2. Dimensions
SREQ 2.6.2.06	The handle of the emergency access device will have the dimensions of the handle of the egress device
	3. Appearance
SREQ 2.6.2.07	The emergency access handle shall be marked with an arrow symbol in contrasting color on the handle
SREQ 2.6.2.08	The RIC-key lock should be protected with a separate cover which can be pushed away easily to make the square available.
SREQ 2.6.2.09	The emergency access and access device shall be surrounded by a luminescent marking of a width of at least 15mm
SREQ 2.6.2.10	The emergency access device shall be in high color contrast to the adjacent area
	4. Activation & forces
SREQ 2.6.2.11	The handle of the emergency access device shall be orientated horizontally to be pulled in a horizontal plane (horizontal activation way of handle).
SREQ 2.6.2.12	The not activated position of the handle of the emergency access device will be the 0° position
SREQ 2.6.2.13	The handle of the emergency access device should rest in 0° (not) activated position after activation



SREQ 2.6.2.14	The 100% door lock released position will be before 165° activation angle of the handle of the emergency access device (see picture 4.C figure E)
SREQ 2.6.2.15	The 100% activated position of the handle of the emergency access device will be limited by a mechanical stop that keeps a free space between the grip of the handle and the sidewall of at least 30mm
SREQ 2.6.2.16	The cover of the handle of the emergency access device should be remove able for staff by turning the key clockwise 90°
SREQ 2.6.2.17	The maximum activation force of the handle of the emergency access device shall be less or equal 150N in direction of movement (exception: the door is isolated)
SREQ 2.6.2.18	The cover of the emergency access device should be set in closed position by staff by pressing it in closed position (snap lock) and the cover is spring loaded
	5. Information & signals
SREQ 2.6.2.19	No signals or alarms should occur than the emergency access device activated signal to the door control unit
	6. Miscellaneous
SREQ 2.6.2.20	The transmission between emergency access device and the door locking device shall consists of a mechanical transmission only (e.g. Bowden cable; not depending on supply energy, pressure transmission and so on)
SREQ 2.6.2.21	The actuation of the emergency access device will not move the door leaves exceptionally at sliding doors without additional grip on the outside of the door leave to open it
SREQ 2.6.2.22	The handle of the emergency access device will withstand a horizontal force of 1,0 kN spread over the width of the grip when at 100% activated position (vandalism resistance)
SREQ 2.6.2.23	The handle of the emergency access device will withstand a force of 1,0 kN from any vertical direction spread over at least 2cm ² at 90° activated position (vandalism resistance)
SREQ 2.6.2.24	The forces for activation of emergency access device shall be measured at an external and internal temperature between -25°C and +100°C