Electric Multiple Unit (EMU)
Fire/Life Safety Features

January 2023

AGENDA

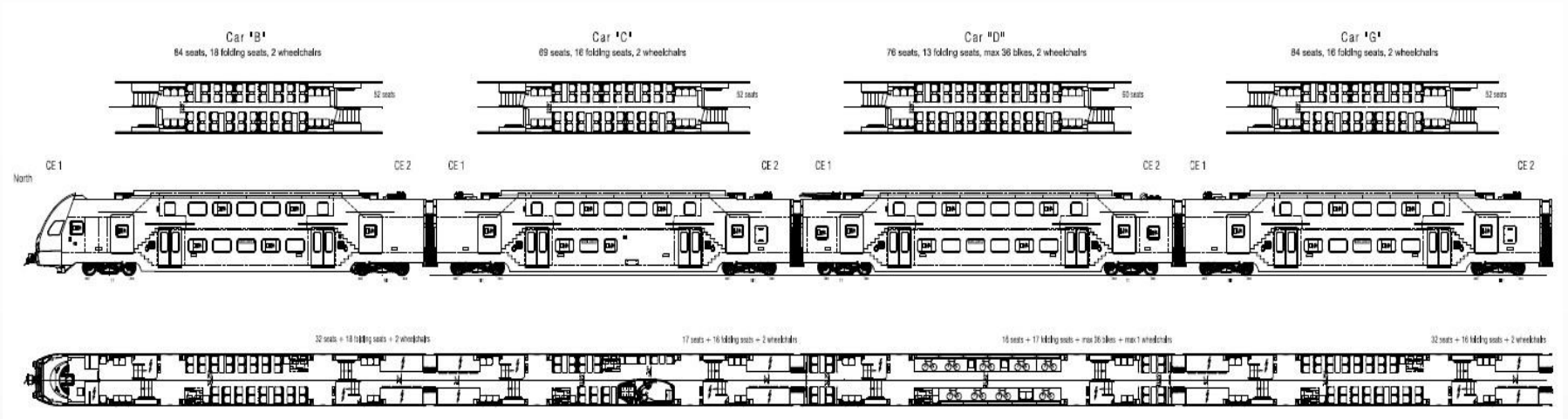
- Train Configuration
- Regulations
- Material Validation
- Emergency Egress/Ingress
- Evacuation Study
- Passenger Intercoms
- Emergency Equipment
- Emergency Markings
- Questions?

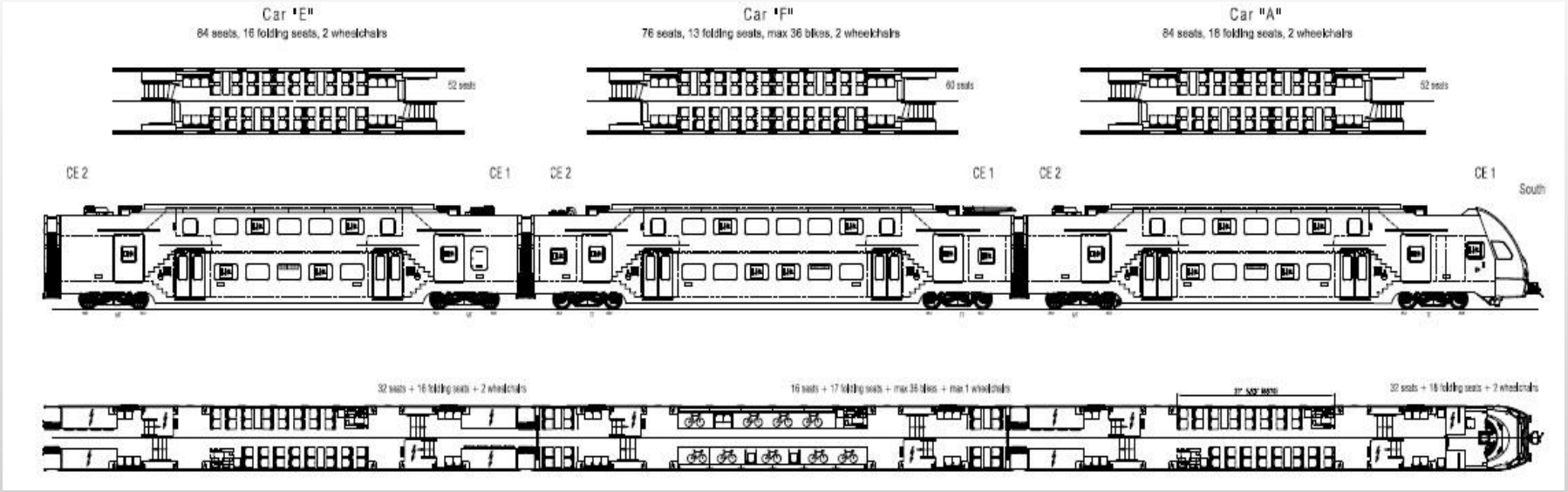
New Caltrain Trainsets

As part of the overall CalMod project Caltrain purchased 133 new Electric Multiple Units (EMU's) which will replace 75% of the existing fleet. The 133 EMU's breakdown to 19 – 7 car consists as shown below.

Each trainset is identical: 2 cab cars, 2 bike cars, 2 coach cars and one additional coach car that is equipped with an ADA compliant restroom.

Train Configuration





Electric Multiple Units (EMU's)

- Code of Federal Regulations (CFR)

49 CFR Part 238 Subpart B: Passenger equipment safety standards
- Windows
- Rescue access
- Emergency lighting
- Emergency communications
- Emergency roof access
- Markings and instructions

49 CFR Part 239 Subpart B: Passenger train emergency preparedness
- Emergency preparedness plan
- Emergency drills
- Debriefing & critiques

- National Fire Protection Association (NFPA)

NFPA 130 (2017 edition): Standard for Fixed Guideway Transit and Passenger Rail

Federal Regulations

49 CFR 238.103 Fire Safety

49 CFR 238.112 Door Emergency Egress and Rescue Access Systems

49 CFR 238.113 Emergency Window Exits

49 CFR 238.114 Rescue Access Window

49 CFR 238.115 Emergency Lighting

49 CFR 238.121 Emergency Communication

49 CFR 238.123 Emergency Roof Access

49 CFR 238.125 Marking and Instructions for Emergency Egress and Rescue Access

49 CFR 238.127 Low-Location Emergency Exit Path Marking

FRA/NFPA Fire Safety Compliance

ASTM E662 - 18

Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

Category	Function of Material	Test Method	Performance Criteria
Cushioning	All individual flexible cushioning materials used in seat cushions, mattresses, mattress pads, armrests, crash pads, and grab rail padding [a–e]	ASTM D 3675	$I_s \leq 25$
		ASTM E 662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 175
Fabrics	Seat upholstery, mattress ticking and covers, curtains, draperies, window shades, and woven seat cushion suspensions [a–c, f–h]	14 CFR 25, Appendix F, Part I (vertical test)	Flame time ≤ 10 sec Burn length ≤ 6 in.
		ASTM E 662	D_s (4.0) ≤ 200

ASTM D3675 - 17

Standard Test Method for Surface Flam
Flexible Cellular Material
Energy Sourc

FRA/NFPA Fire Safety Compliance

ASTM E162 - 16

Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

Other vehicle components	Seat and mattress frames, wall and ceiling lining and panels, seat and toilet shrouds, toilet seats, trays and other tables, partitions, shelves, opaque windscreens, combustible signage, end caps, roof housings, articulation bellows, exterior shells, nonmetallic skirts, and component boxes and covers[a,b,i,j,k]	ASTM E 162	$I_s \leq 35$
		ASTM E 662	$D_s(1.5) \leq 100$ $D_s(4.0) \leq 200$
	Thermal and acoustical insulation[a,b]	ASTM E 162	$I_s \leq 25$
		ASTM E 662	$D_s(4.0) \leq 100$
	HVAC ducting[a,b]	ASTM E 162	$I_s \leq 25$
		ASTM E 662	$D_s(4.0) \leq 100$
	Floor covering[k,l]	ASTM E 648	CRF ≥ 5 kW/m^2
		ASTM E 662	$D_s(1.5) \leq 100$ $D_s(4.0) \leq 200$
	Light diffusers, windows, and transparent plastic windscreens[b,i]	ASTM E 162	$I_s \leq 100$
		ASTM E 662	$D_s(1.5) \leq 100$ $D_s(4.0) \leq 200$

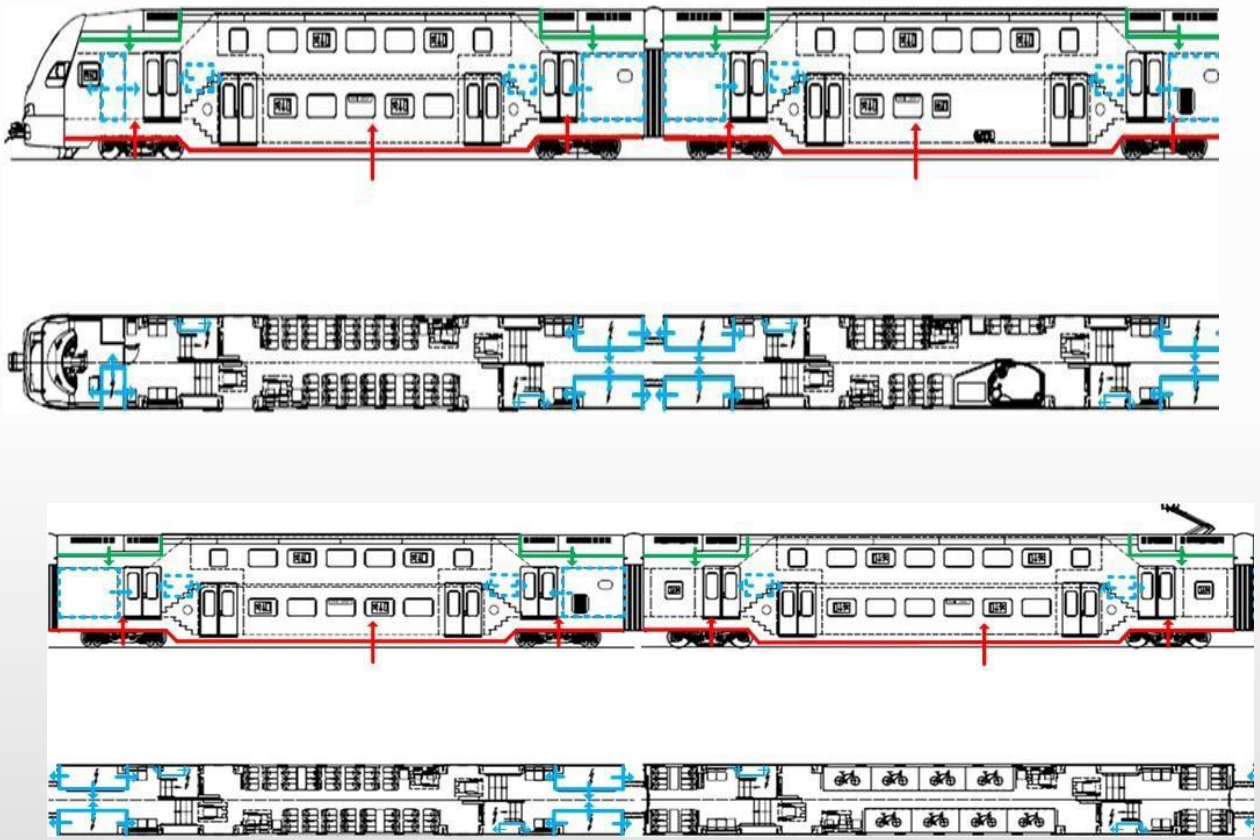
FRA/NFPA Fire Safety Compliance

ASTM E119 - 18ce1

Standard Test Methods for Fire Tests of Building Construction and Materials

Elastomers[a, b]	Window gaskets, door nosings, intercar diaphragms, seat cushion suspension diaphragms, and roof mats	ASTM C 1166	Flame propagation ≤ 100 mm (4 in.)
		ASTM E 662	D_s (1.5) ≤ 100 D_s (4.0) ≤ 200
Wire and cable	All	See 8.6.7.1.1.1 through 8.6.7.1.3.	See 8.6.7.1.1.1 through 8.6.7.1.3.
Structural components[m]	Flooring,[n] other[o]	ASTM E 119	Pass

EMU Fire Barriers

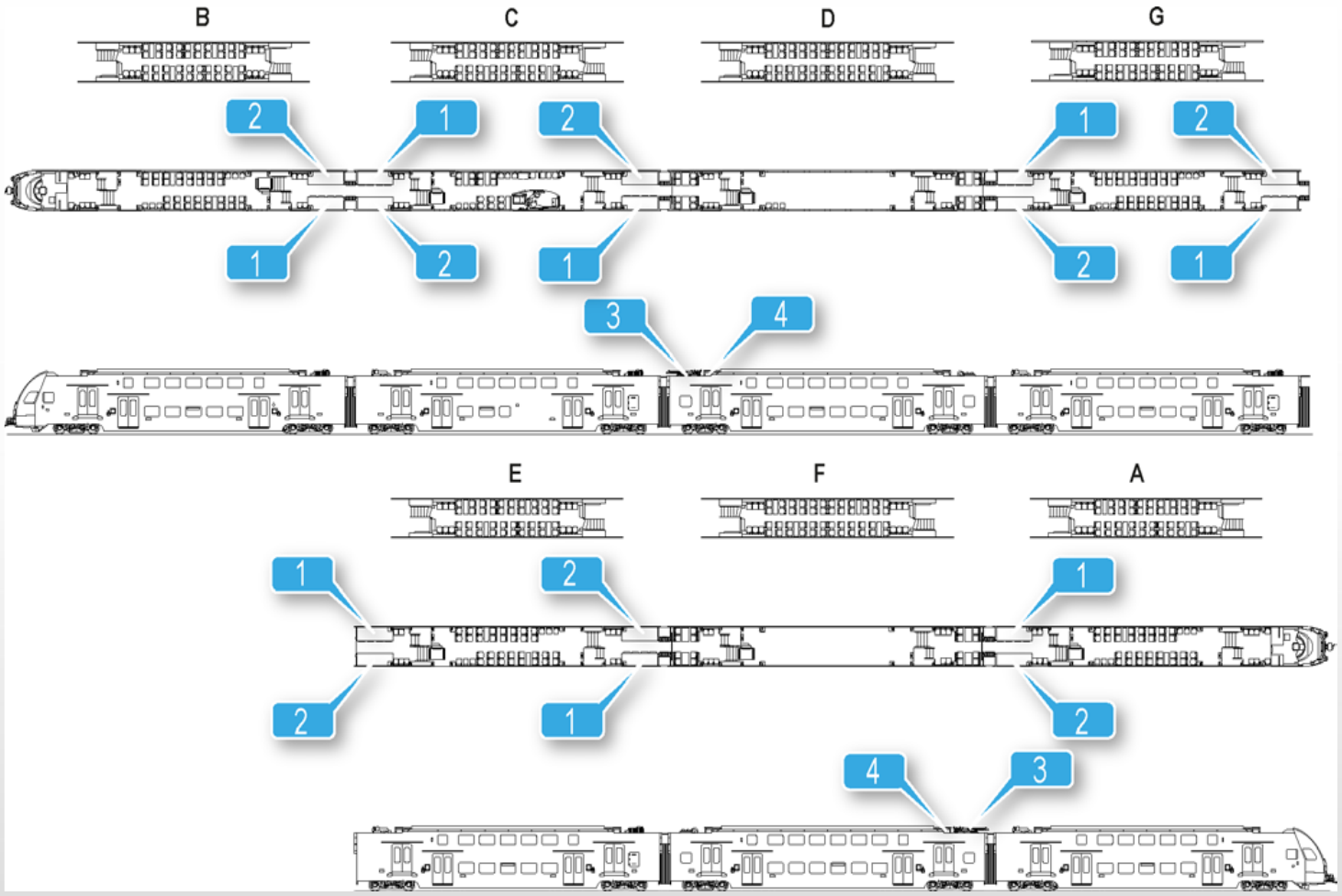


Danger – High Voltage

All areas within the train that contain high voltage are marked.

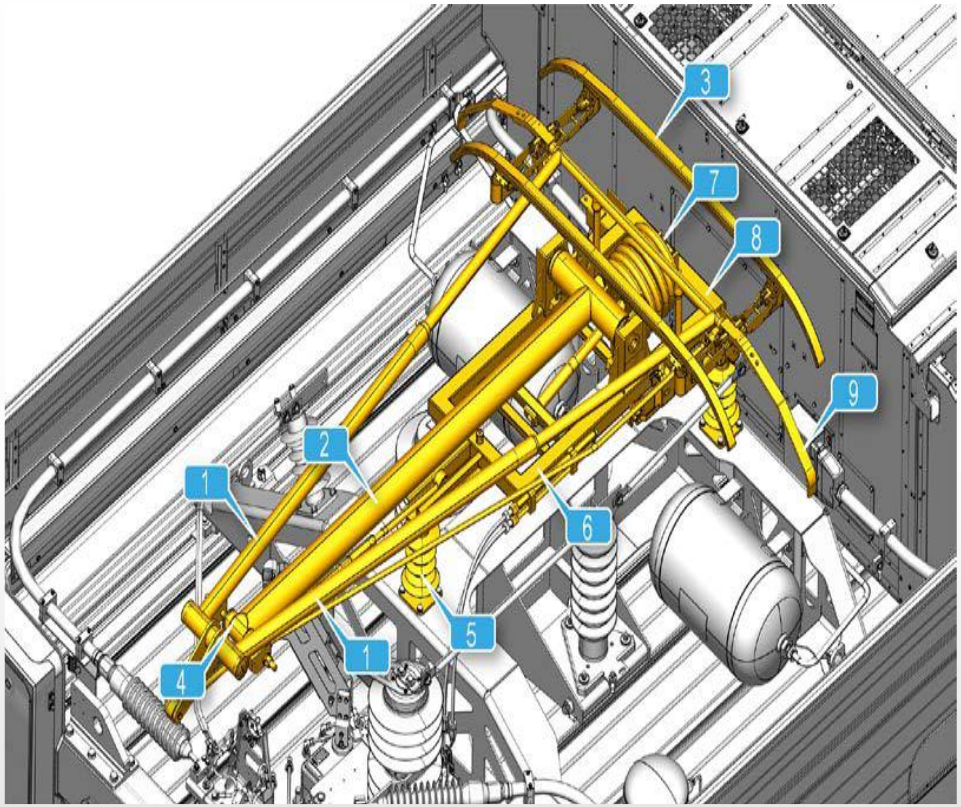
Do not open until you have confirmation that the power has been removed!

EMU Power Supply

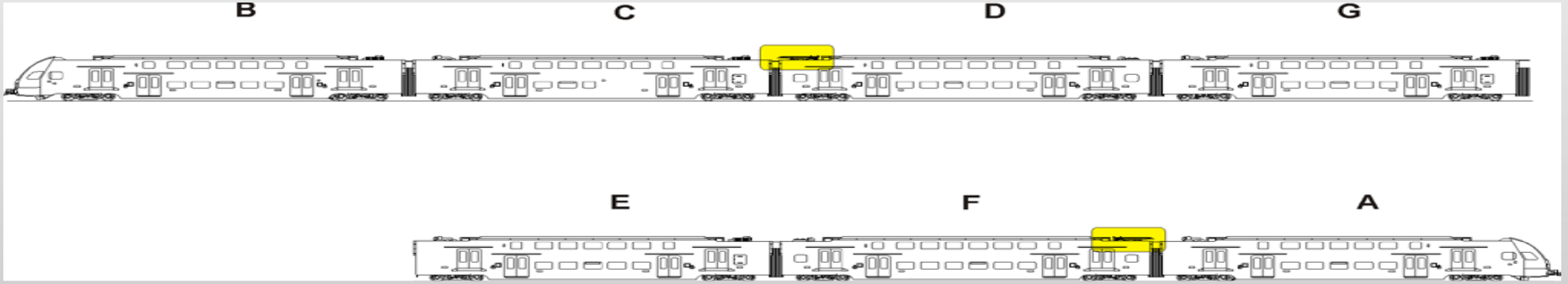


1 Transformer 2 Power Converter 3 Pantograph 4 Main Circuit Breaker

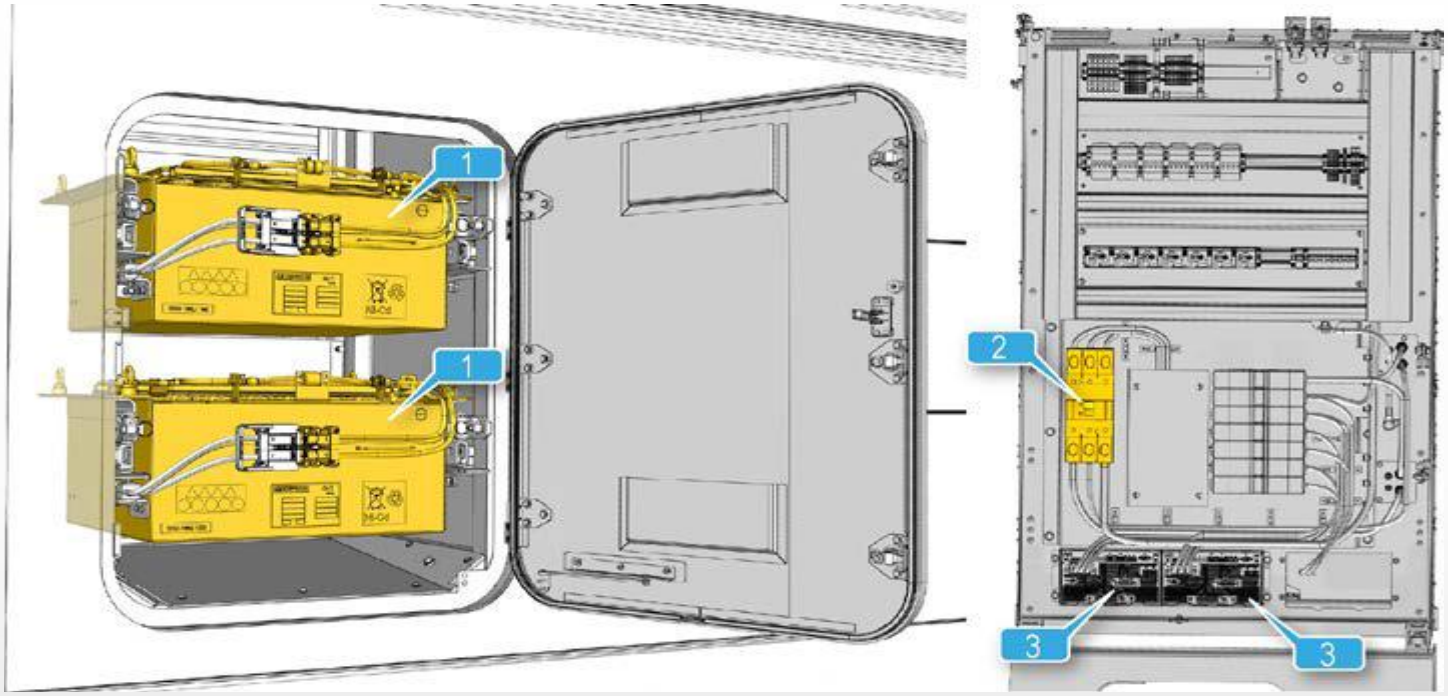
EMU Pantograph



1 Top arm
2 Bottom arm
3 Carbon strip
4 Hinged joint
5 Insulator
6 Base frame
7 Air bellows cylinder
8 Collector head support
9 Pantograph horn



EMU Battery



1. Battery
2. Battery Master Switch
3. Battery Main Battery Switch and Charger

Note: There is one 72 VDC battery in control cabinets AE13 and AE23 in cars C, G and E. The battery consists of two battery boxes, which are arranged one above the other in trays. In addition, the AE13 and AE23 control cabinets all contain two synchronized battery chargers.

EMU Fire Detection Areas

Fire detection area Toilette

Fire detection area maschine room

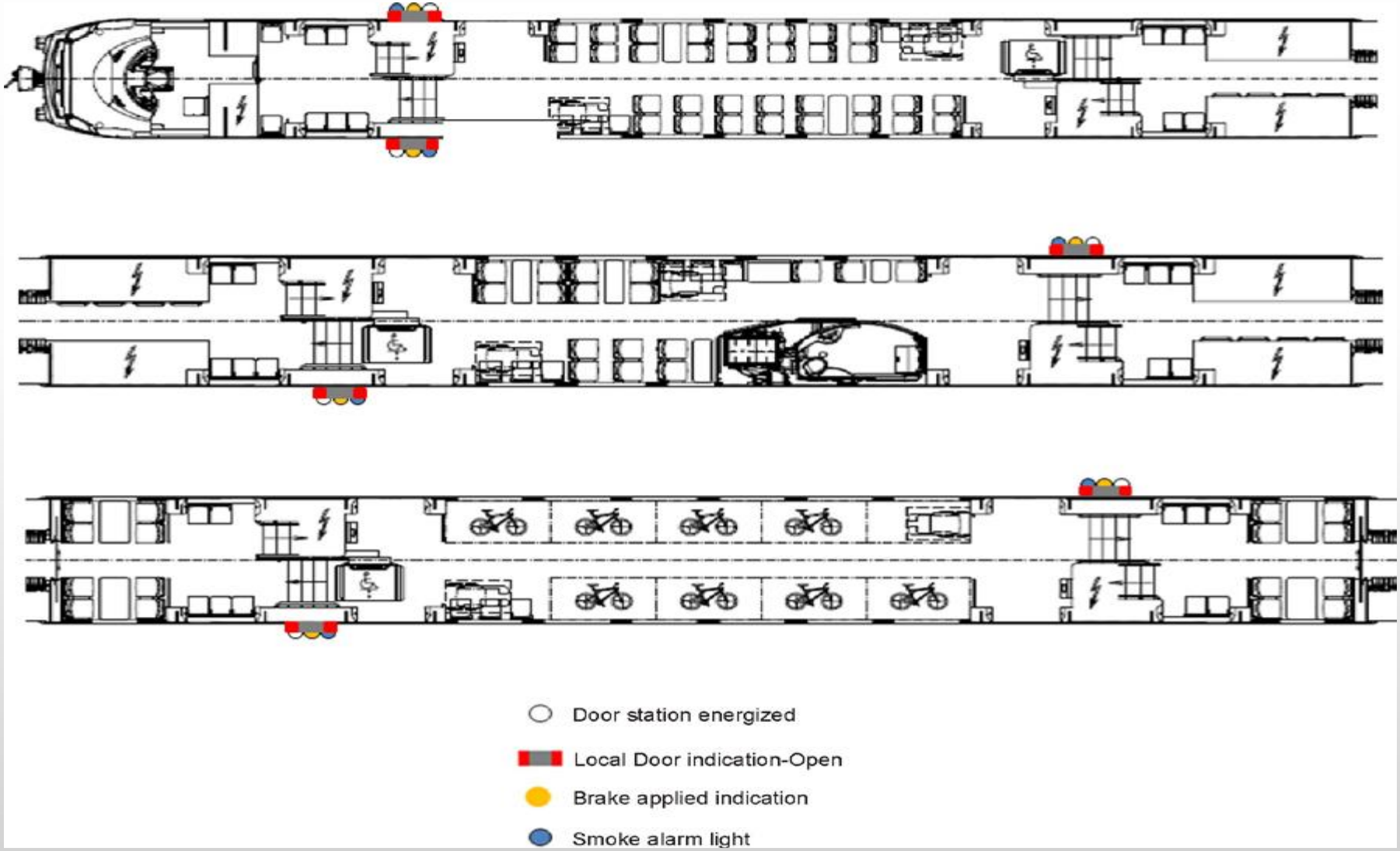
Fire detector toilette

Fire detector/ Heating cable maschine room

Fire detection area cab

Fire detector cab

EMU Exterior Indicator Lights



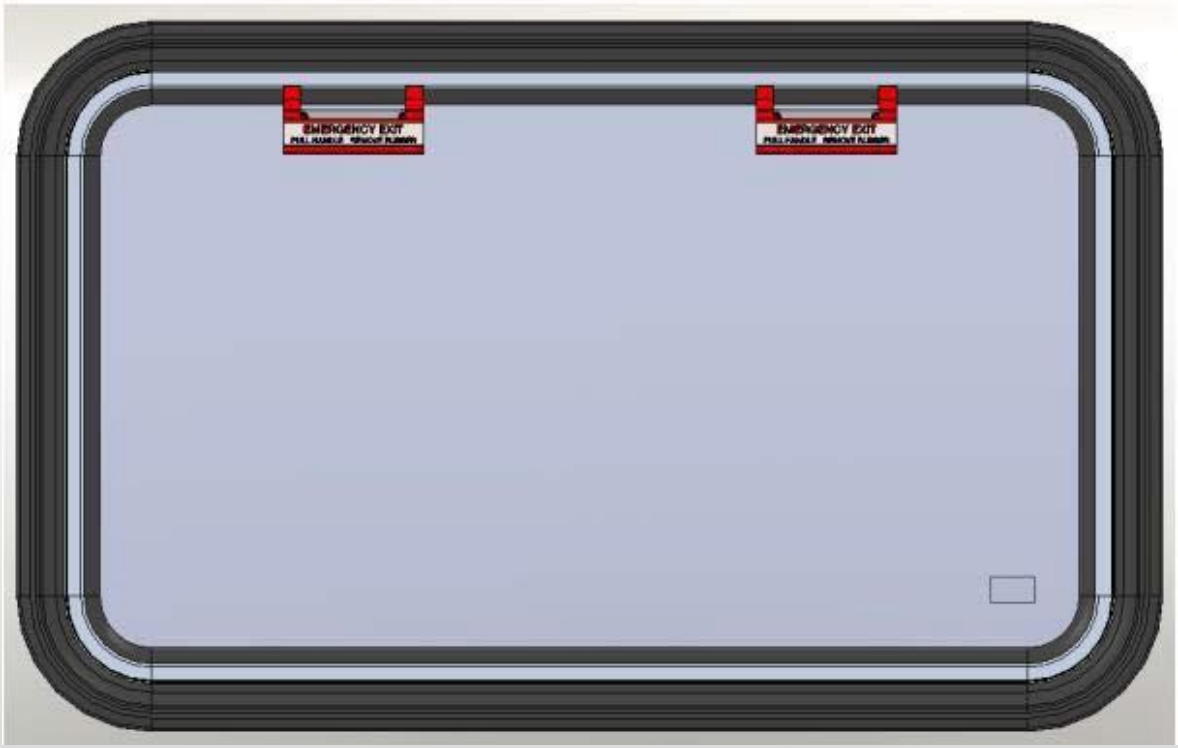
EMU Train Engineer Cab

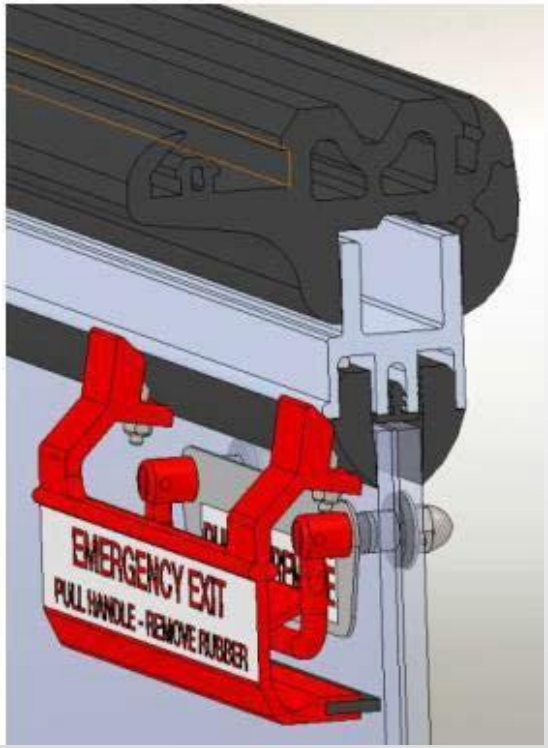
FB1	TOD I Diagnostic and EMU status
FB2	*TOD II Train operation (Includes fire detection systems)*
FB3	Positive Train Control (PTC) screen
FB4	*PIS/manometers (Passenger Information System)*
FB5	Train radio/communication
FB6	Control, operating mode
FB7	Button for train control, signal horn

49 CFR 238.113 Emergency Window Exits

- 4 emergency exit windows on upper level
- 4 emergency exit windows on the lower level
- Emergency exit windows on the intermediate level that has passenger seating
- Window must be a minimum of 26 inches horizontally by 24 inches vertically

Emergency Window Exits





CalMod

RESCUE ACCESS

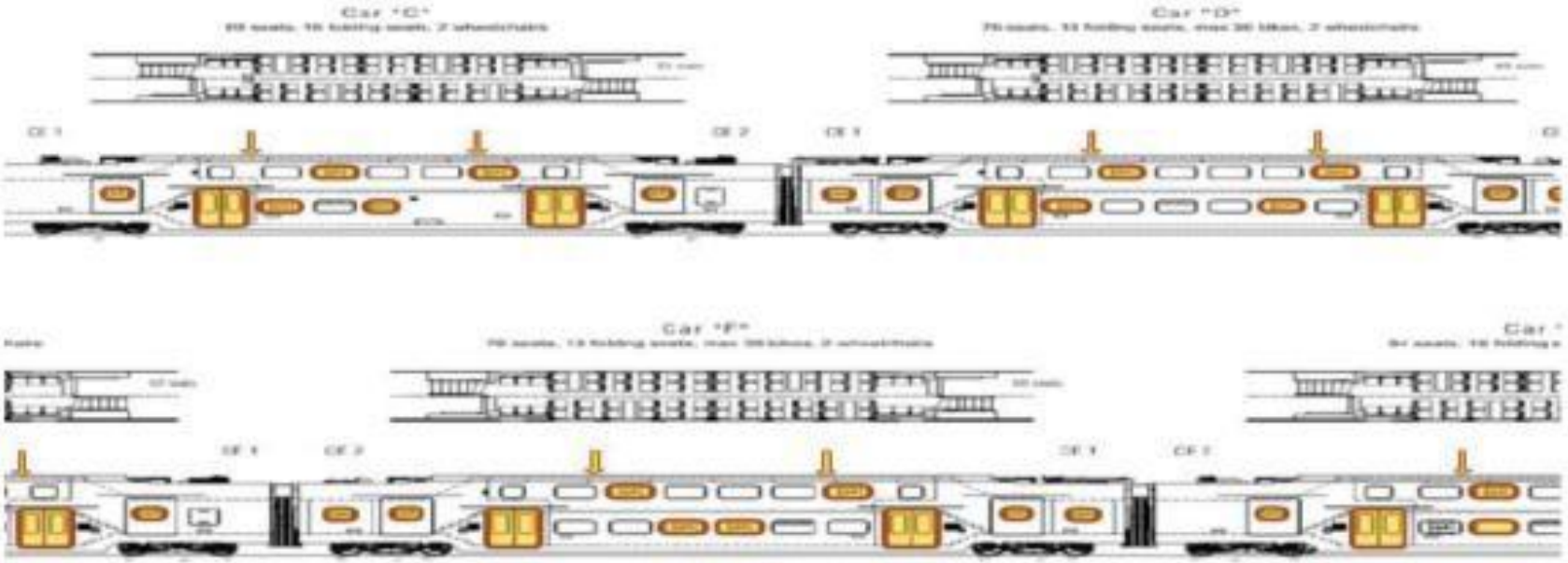


Figure 5-1: Emergency accesses

Caltrain

49 CFR 238.114 Rescue Access Window

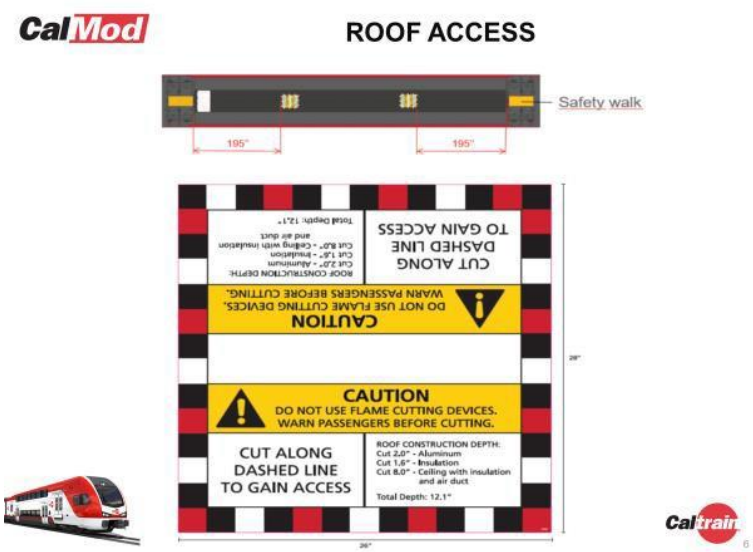
- Intermediate level: Minimum of 2 rescue access windows in a seating area.
- Main and lower level: Minimum of 1 rescue access window per side.
- Window must be a minimum of 26 inches horizontally by 24 inches vertically

49 CFR 238.123 Emergency Roof Access

- One emergency access point (structurally weak point) within each half of the roof (divided from top to bottom and from left to right)

Emergency access through the roof is done by cutting along the “soft spot” in the trains roof. The roof construction is made up of:

- 2” of aluminum
- 1.5” of insulation
- 1.5” of ceiling and airduct



49 CFR 238.112 Door Emergency Egress and Rescue Access Systems

To access the interior of the train - pull red handle out, doors will release, pull outward and then push apart.

49 CFR 238.112 Door Emergency Egress and Rescue Access Systems

Evacuation Study

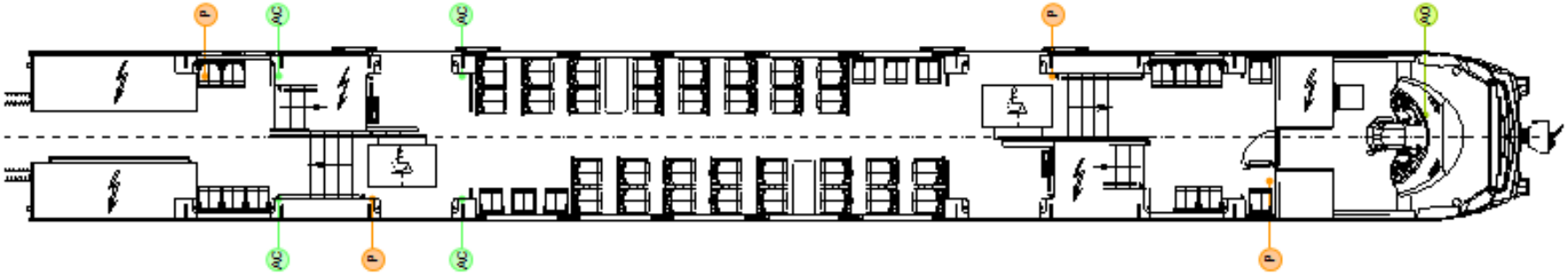
Scenario

- Evacuation over intermediate deck door with full train to platform – 132 seconds
- Evacuation over intermediate deck door with only seats being occupied to platform – 64 seconds
- Evacuation over lower deck level door with full train to the roadbed – 164 seconds
- Evacuation over lower deck level door with only seats being occupied to the roadbed – 65 seconds

Evacuation instructions

Passenger evacuation instructions are located near each exit door.

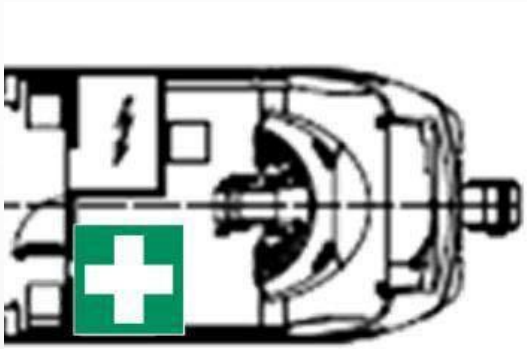
Passenger Emergency Intercom

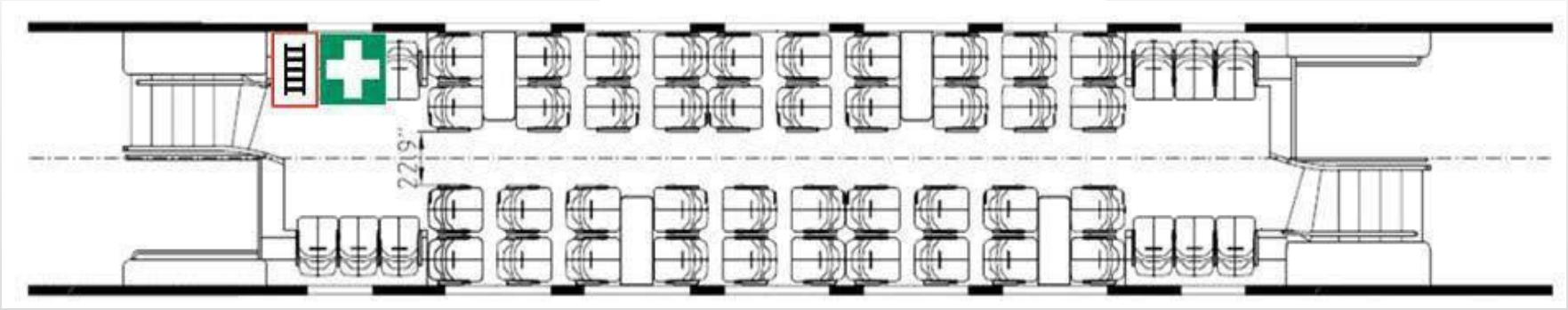


P Passenger Emergency Intercom (PEI)
AC Audio Control Head Conductor (ACH-C)
AO Audio Control Head Operator (ACH-O)

Emergency Equipment

- Fire Extinguisher
- Pry Bar
- Flashlight
- First Aid Kit
- Emergency Ladder





49 CFR 238.125 Marking and Instructions for Emergency Egress and Rescue Access

49 CFR 238.127 Low-Location Emergency Exit Path Marking

- High Performance Photo-Luminescent (HPPL) on interior
- Retro-Reflective markings on exterior

Emergency Egress Marking

Ceiling marking designating Location of emergency window exit

Emergency exit window with instructions

HPPL Low Level Exit Path Marking

Low level path marking at side door exit

Exit path marking at end doors

49 CFR 239 – Passenger Train Emergency Preparedness

- 239.101: Emergency Preparedness Plan
  - *1 fire extinguisher per car*
  - *1 pry bar per car*
  - *1 flashlight per crew member*
- 239.103: Passenger train emergency simulations
  - *1 full scale drill per year*
- 239.105: Debriefing and Critique
  - *Conducted within 60 days of simulation*
- 239.107: Emergency Exits
  - Markings
  - Inspection, Maintenance & Repairs

QUESTIONS?