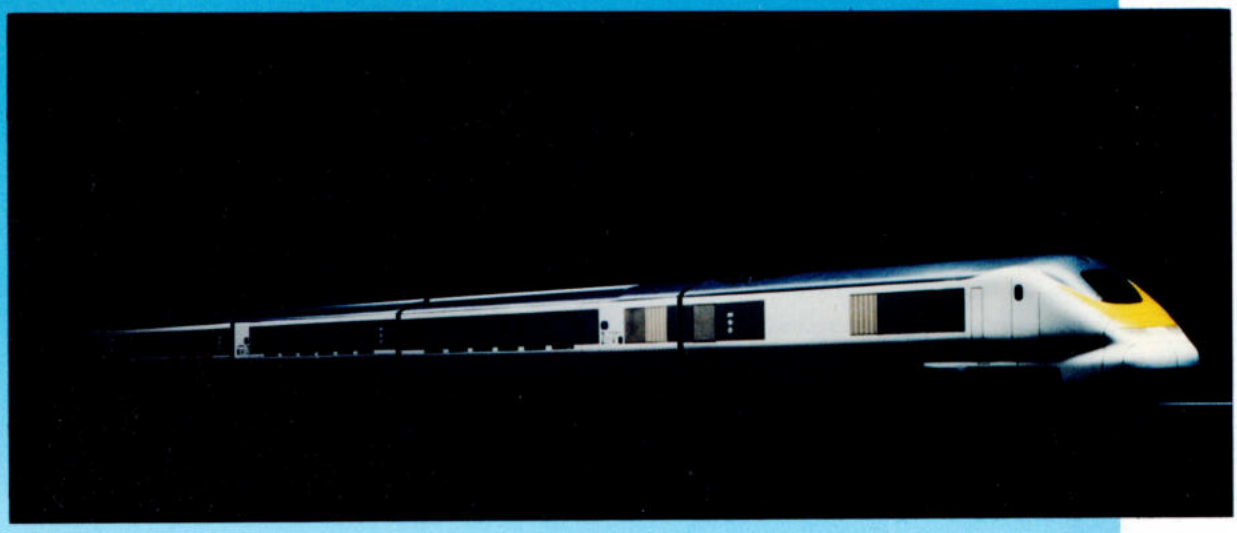
TMST

TRANSMANCHE SUPER TRAIN



THE FIRST INTERNATIONAL HIGH SPEED TRAIN

MAIN FEATURES

Operator
British Railways
French National Railways
Belgian National Railways

Manufacturer
"TransManche Super Train Group"
Belgian consortium :BN
ACEC Transport

French consortium :GEC Alsthom
ANF Industrie
De Dietrich

British consortium :GEC Alsthom Transportation Projects Ltd.
Brush Electrical Machines Ltd.

Scope of Contract
30 trains of 2 locomotives and 18 coaches

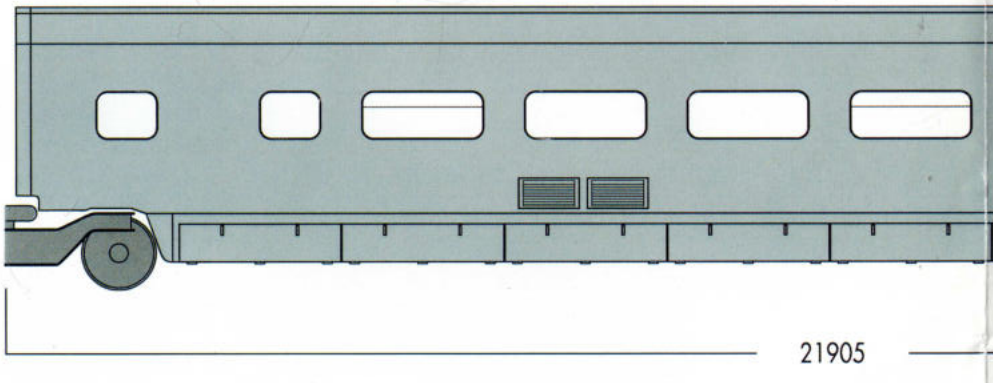
Passenger Capacity (/train)
1st class : 210
2nd class : 584
Folding seats : 52

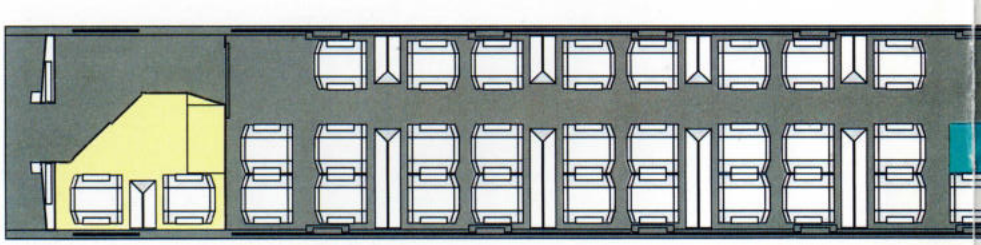
Train Length
393,5m

Power Supply
25 kV 50 Hz on the French network
3 kV DC on the Belgian network
750 V DC on the British network

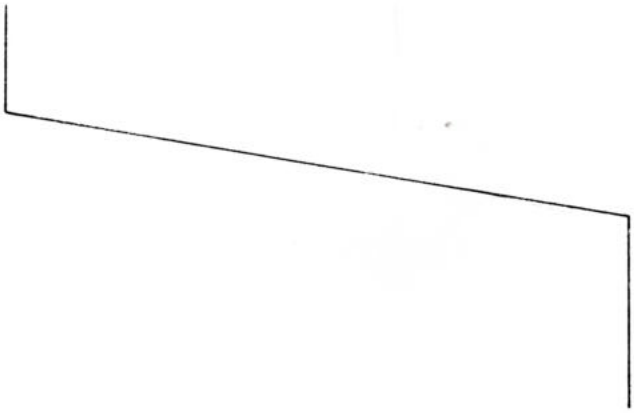
Max. Power
12 x 1 MW

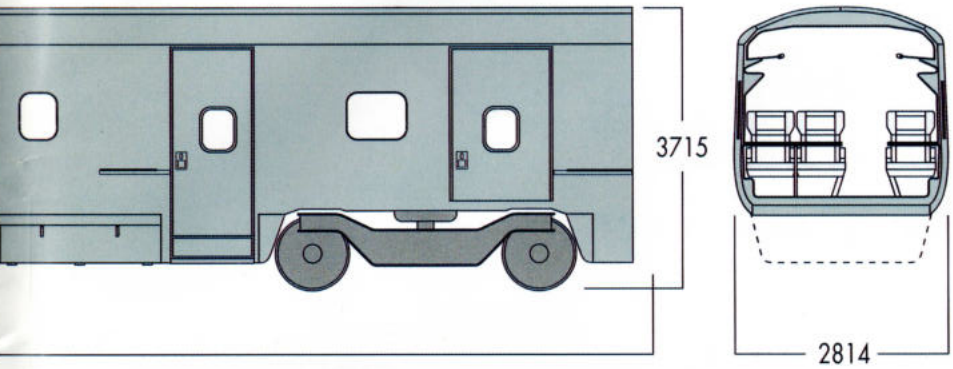
Max. Speed
300 km/h.





Baggage stack | Uncoupling control location | Transfer wheelchair location | Police & customs c



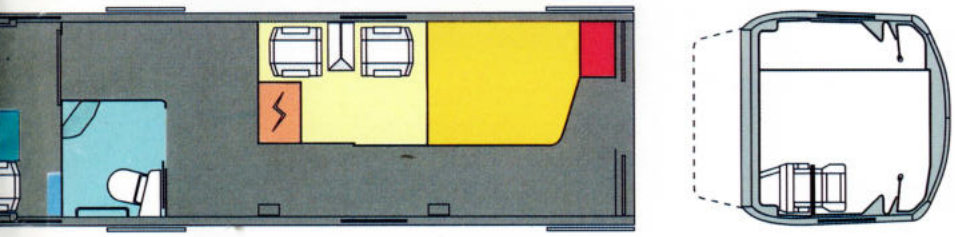


Coaches R9 and R10

Intermediate coach allowing splitting up of the train

First class, no smoking
Special facilities for the disabled
Special accomodation for customs staff & police

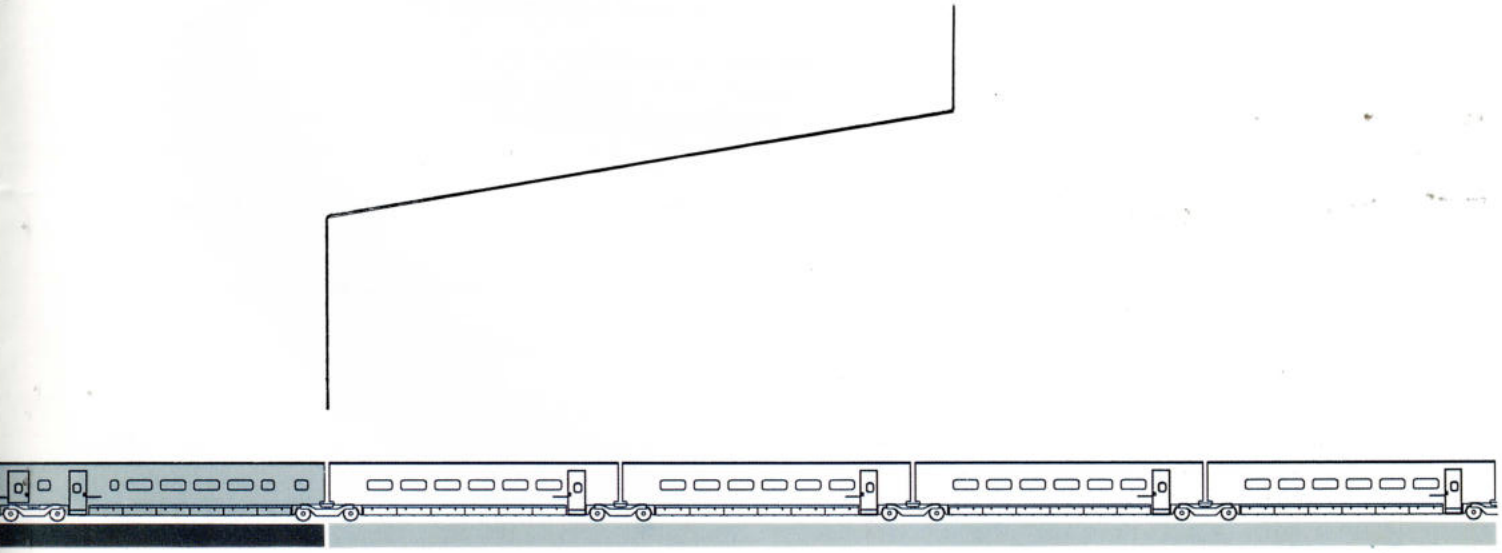
Number : 60
Passenger capacity : 27 passengers
Length : 21,905 m
Width : 2,814 m
Height : 3,715 m
Weight (empty without bogies): 27 tons



Bodyshell R7, R8, R11, R12

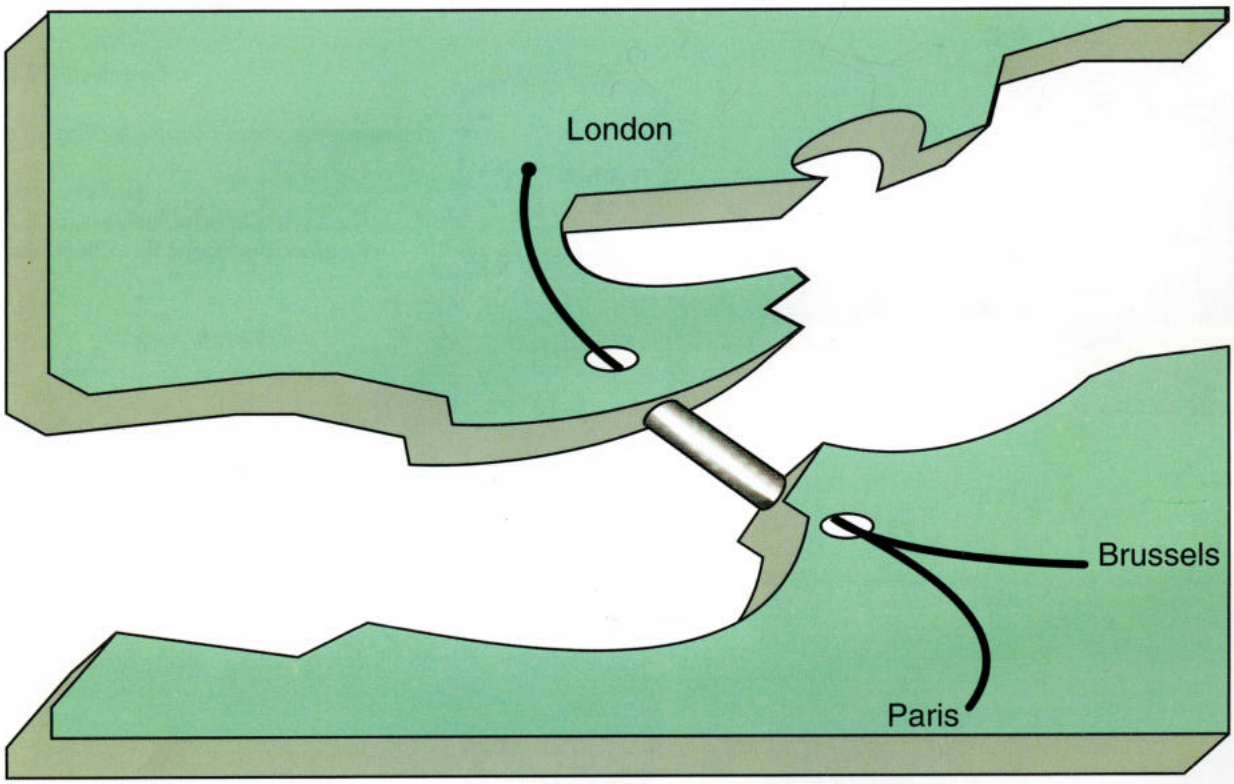
Number : 120
Length : 18,700 m
Width : 2,814 m
Height : 3,715 m

ompartment | Disabled persons | Disabled persons' WC | Electrical cubicle and intercom post



TRANSMANCHE SUPER TRAIN

THE FIRST HIGH SPEED LINK IN EUROPE



Brussels-London: 2h 36 min Brussels-Paris: 1h 28 min Paris-London: 3h Tunnel crossing : 35 min

The TMST (high speed train) will link Brussels, Paris and London using the Channel tunnel. BN is a member of the TMST group and the leader of the Belgian consortium. Our company was awarded the contract to develop and build the central R9 and R10 coaches and to manufacture all first-class bodyshells. In addition to this, BN will supply the external door panels, window frames and communication system for all coaches.

Particular attention is paid to aerodynamics in order to decrease air resistance.
As TMST will run on the Belgian, French and English networks, it is necessary to take into account the various voltages - Belgium's 3000 V DC, France's 25 kV AC and Great Britain's 750 V DC- and to accomodate the different railway clearances.

TMST's developers put the stress on passenger safety. Fire protection is provided by using fireproof materials and installing uncoupling devices to split up the train in case of emergency.

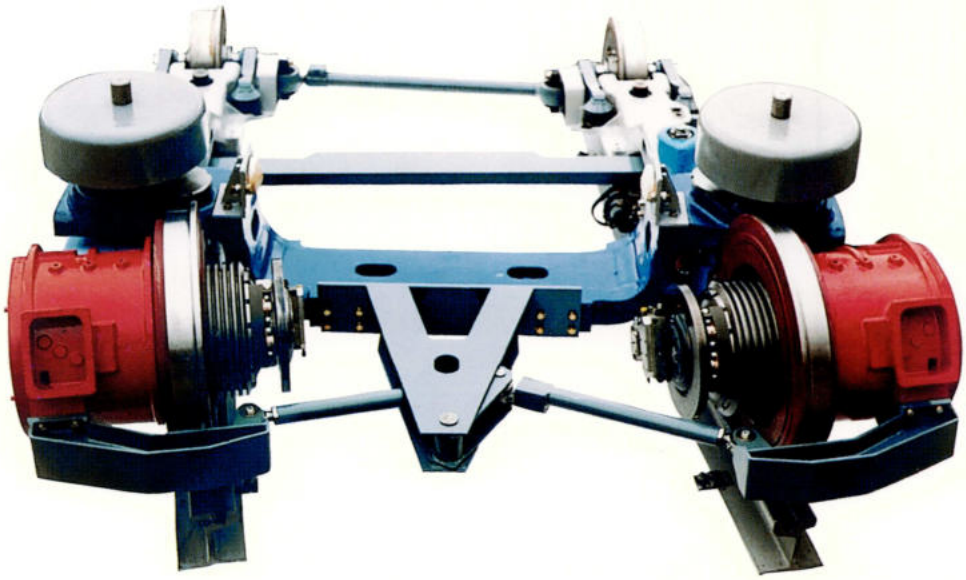
Passenger comfort is also a constant concern : air-conditioning, noise reduction, easy access for the less mobile.

The Transmanche Super Train, which will be operational in 1993, on the opening of the Channel tunnel, is the first step towards a European high speed network.

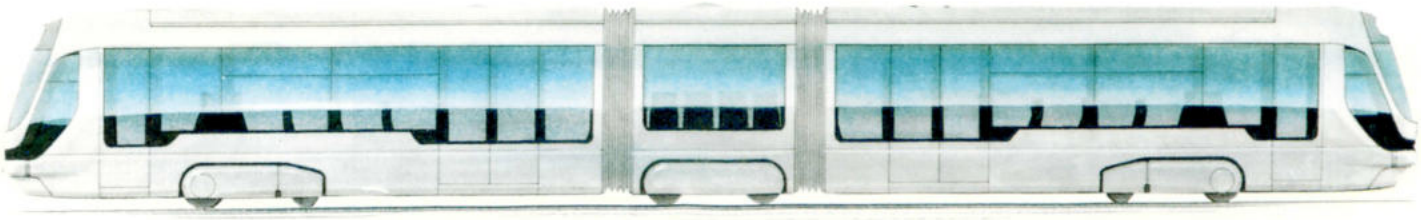
BOMBARDIER BN
Avenue Louise 65 - 1050 Brussels - Belgium Tel. 32 2 535 55 11 Fax. 32 2 539 10 17

BN division of
Bombardier Eurorail

Tram 2000 Brussels' 100% Low-Floor LRV



Designed by INOV and Design Triangle



General data

Track gauge	1.435 m
Length	22.8 m
Width	2.3 m
Height	3.4 m
Floor height	350 mm (constant)

Wheel diameter

Motor wheel	640 mm
Driving wheel	375 mm
Weight (empty)	31.9 t.

Passenger capacity

Seats	32
Standees (6p/m^2)	140

Voltage

Overhead catenary	650 Vdc
Intermediate	3x380 V 50 Hz
Control	24 Vdc

Doors

Single	4 doors
Double	4 doors
Type	sliding plug

Performances

Maximum speed	70 km / h
Acceleration	1.25 m / s^2
Service brake	1.25 m / s^2
Emergency brake	3 m / s^2
Minimum track radius	17.5 m
Maximum gradient	7.5 %

AC drive

Supplied by ACEC Transport.
GTO controlled inverter.
Watercooled wheel motor.
Fully regenerative or rheostatic electrical service brake.

Bogies

End bogies: BA 2000 developed by BN.

- Articulated frame allowing each wheel to be tangent to the rail.
- Low noise-emission level.
- Excellent dynamic stability.
- 2 independent wheels driven by AC-motor placed inside the wheel.
- 2 driving wheels.
- Rubber primary and air spring secondary suspension.

Intermediate bogie:

- BR 4x4 developed by GEC-Alsthom and BN
- 4 independent wheels driven by AC-motor placed inside the wheel
- Rubber primary and air spring secondary suspension

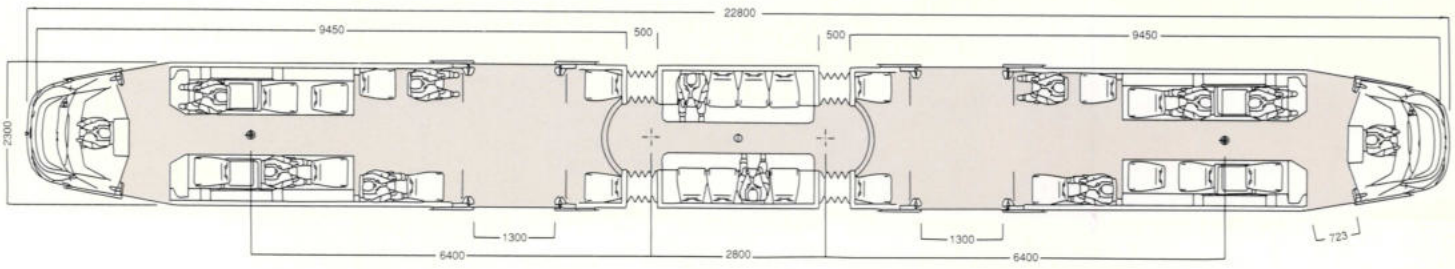
A real low floor (350 mm high) over the full vehicle length

- Constant 350 mm floor height even at the bogie location
- No internal steps
- No internal ramps

Low operating costs

- Reduced energy consumption
- Corrosion-free materials
- Fully sealed traction motor
- Easy repairable body

51 vehicles have been ordered by the City of Brussels (STIB) to begin operation at the end of 1993



BN division of
Bombardier Eurorail

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LIGHT RAIL TRANSIT SYSTEM — LRV (LIGHT RAIL VEHICLES)

In response to the major economic problems of energy use and the population explosion and city migration experienced by many countries, BN's Research Department is engaged in an audacious R & D programme. The results so far can be seen in the form of highly advanced equipment.

A major attraction of the light rail transit system is its greater flexibility and versatility, making it adaptable to any infrastructure and to the geographical and architectural features of any city.

It can be placed in high-speed subways, on elevated structures, in the streets, on private right-of-ways with or without level crossings, on abandoned railroads, etc. Often a mixed solution of these possibilities is adapted.

The light rail transit system can be gradually extended to a developing transport demand and, when necessary, the infrastructure can also be adapted.
With a staged construction of the system, investment, too, can be gradual.

The system is characterized by various types of cars with a wide range of transport capacities.
The light rail vehicles designed by BN are high-capacity, articulated 6 or 8 axle units which can also operate in trains of 2, 3 and 4 units.

Articulation of BN vehicles is highly reliable and allows curves down to 25 m radius. The inner lining has been carefully chosen to obtain maximum sound and thermal insulation.

In 1980/81, Charleroi and the Belgian coast saw this system put into operation. Furthermore, the cities of The Hague, Rio de Janeiro and Manila have opted for the "BN Articulated Light Vehicle". With a view to promoting even further BN exports to South America, BN has signed a collaboration agreement with the Brazilian compagny COBRASMA.

A similar agreement was signed with BOMBARDIER of Canada in 1979. This had the aim of promoting and marketing passenger transport equipment in the USA and Canada. In 1982 BN/Bombardier obtained a contract for 26 LRVs for the city of Portland, Oregon, USA, which were supplied, in 1984-85.

The years 1988-90 were equally important for several reasons:
1988 saw the orders for 45 Stadstrams for Amsterdam (delivery 1990-91) and for 13 Sneltrams (delivery 1990). 1989 represented a break-through into the UK market with the order for 44 automated LRV for the Docklands Light Rail system. In 1990 the city of The Hague ordered another batch of 34 bi-articulated 8-axle LRV's which will be built as from 1992. Meanwhile the LRV 2000 with full length low floor design on basis of the bogie BAS 2000 is being developed and built for extensive testing as from 1990.

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"Sneltram" Light Rail Vehicle
Amsterdam (Netherlands)

BN division of
Bombardier Eurorail

General characteristics

Track gauge	1.435 m
Body length	30.080 m
Body width	2.650 m
Floor height	1.100 m
Height rail to roof	3.424 m
Wheel diameter, new	0.690 m
Doors : number	12 double
type	sliding-plug
free opening	1.300 m
Weight, empty	46.3 t
Seats	64
Standing passengers (4 pass. / m²)	169
Total operational capacity	233

Performance characteristics

Max. service speed	70 km/h
Acceleration rate	1.3 m/sec²
Average service deceleration	1.5 m/sec²
Emergency deceleration rate (depending on pass. load)	3 to 4 m/sec²
Minimum curve radius	40 m

Articulation

One BN patented wide passage articulation, full passenger protection and anti-vandalism design.

Bogies

Three BN bi-motor bogies providing 100% adhesion. Resilient wheels.

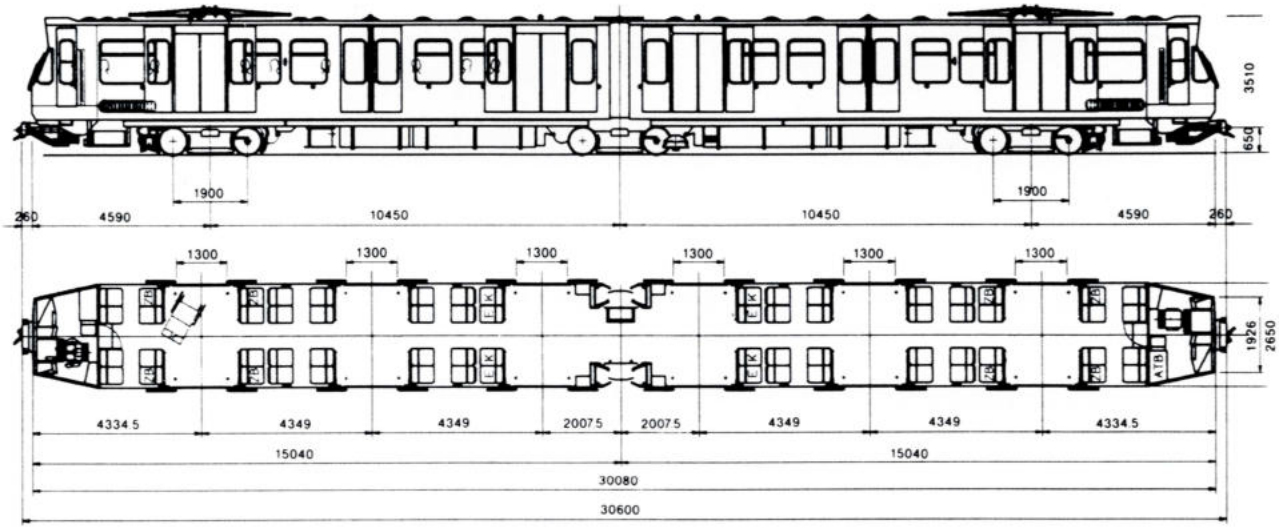
Propulsion system and electrical auxiliaries

(designed and realized by Holec, Netherlands)
Power supply : 600 V d.c. overhead / 750 V d.c. 3-rail.
Motor power : 6 x 77 kW (cont. rating).
DC / AC invertor control with electrodynamic and regenerative brake system. Two separate traction groups.
Auxiliaries 24 and 110 V d.c. & 220 / 380 V a.c.

Brake equipment

Service brake : electrodynamic and regenerative.
Substitution and stopping brake : friction brake system with discs : hydraulically operated.
Emergency : supplemented with 6 electro-magnetic track brakes.

Thirteen vehicles have been delivered to the GVBA (Urban transportation company of Amsterdam) in 1990 for the rapid rail link Amsterdam-Amstelveen. An additional order for twelve vehicles has been obtained in 1992.



6-axle articulated light rail vehicle for the city of Amsterdam, Netherlands.

BN division of
Bombardier Eurorail

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"Stadstram" Light Rail Vehicle
Amsterdam (The Netherlands)

BN division of
Bombardier Eurorail

General characteristics

Track gauge	1.435 m	
Body length	25.630 m	
Body width	2.350 m	
Floor height		
normal	0.867 m	
midsection	0.277 m	
Height, rail to roof	3.191 m	
Wheel diameter new	0.662 m	
Doors:		
number type 11 G	6 double + 2 single	
number type 12 G	3 double + 1 single	
type	sliding-plug	
free opening	1.200 m	
Weight empty	37 t	
	11 G	12 G
Number of seats	52	64
Standing passengers (4 pass/m²)	93	89
Total passengers	145	153

Performances

Max. service speed	70 km/h
Acceleration rate	1.25 m/s²
Average service deceleration	1.50 m/s²
Emergency deceleration rate (depending on pass. load)	3 to 4 m/s²
Minimum track radius	16.5 m

Articulation

Two BN patented wide passage articulations, full passenger protection and anti-vandalism design.

Bogies

Four BN bi-motor bogies B3 type providing 100 % adhesion.
Resilient wheels.

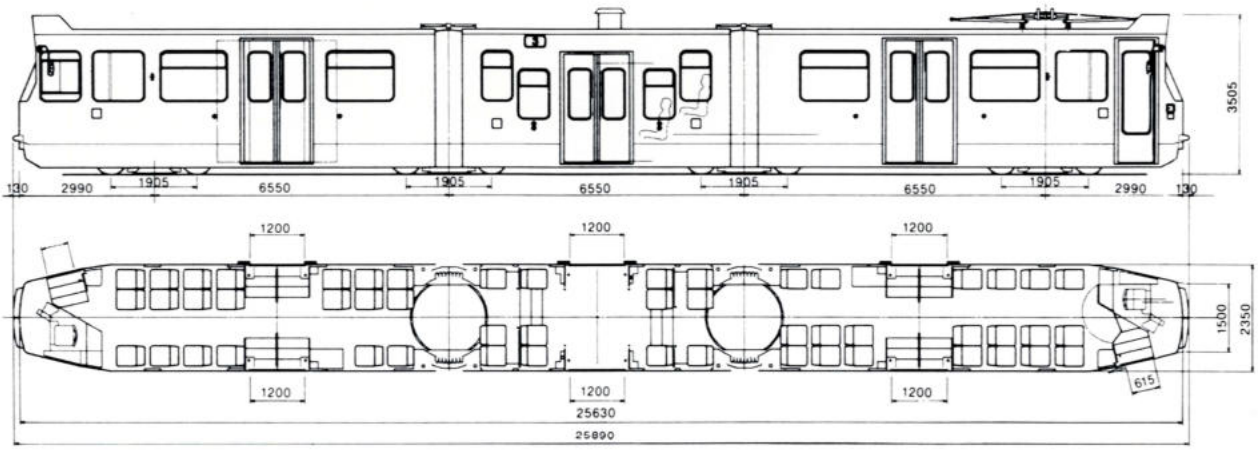
Propulsion system and electrical auxiliaries

(designed and realized by Holec, The Netherlands)
Power supply: 600 V d.c. overhead wire.
Motor power: 8 x 38.5 kW (cont. rating).
d.c./a.c. invertor control with electrodynamic and regenerative brake system. Two separate traction groups.
Auxiliaries 24 V d.c. & 220/380 V a.c.

Brake equipment

Service brake: electrodynamic and regenerative.
Substitution and stopping brake: friction brake system with 8 drums: hydraulically operated.
Emergency: supplemented with 8 electro-magnetic track brakes.

Twenty of type 11 G and 25 of type 12 G have been delivered in 1989-90 to GVBA (Urban transportation company of Amsterdam) and are operated in extensive service.



8-axle articulated light rail vehicles for the city of Amsterdam, The Netherlands.
Type 11 G: two-direction version. Type 12 G: one-direction version.

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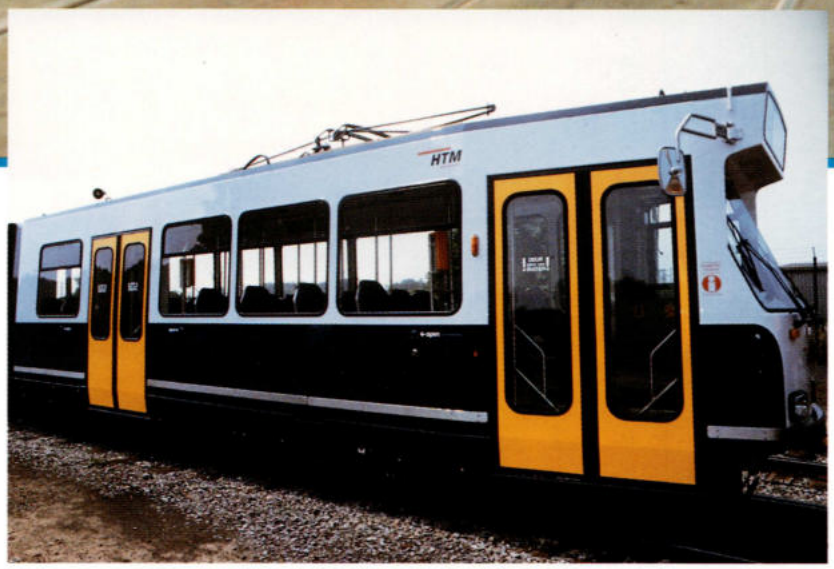


Light Rail Vehicle
The Hague (The Netherlands)

BN division of
Bombardier Eurorail

General characteristics

Track gauge	1.435 m
Body length	28.900 m
Body width	2.350 m
Floor height	0.860 m
Height, rail to roof	3.185 m
Wheel diameter, new	0.665 m
Doors : number	5 double
type	swing-plug
free opening	1.300 m
Weight, empty	38 t
Number of seats	77
Standing passengers (4.5 pass/m²)	109
Total passengers	186

Performances

Maximum service speed	70 km/h
Acceleration rate	1.2 m/s²
Average service deceleration	1.3 m/s²
Emergency deceleration rate (depending on pass. load)	3 to 4 m/s²
Minimum track radius	16 m

Articulation

Two BN patented wide passage articulations, full passenger protection and anti-vandalism design.

Bogies

Four B3 bi-motor bogies providing 100 % adhesion.
Elastomeric secondary suspension.
Resilient wheels.

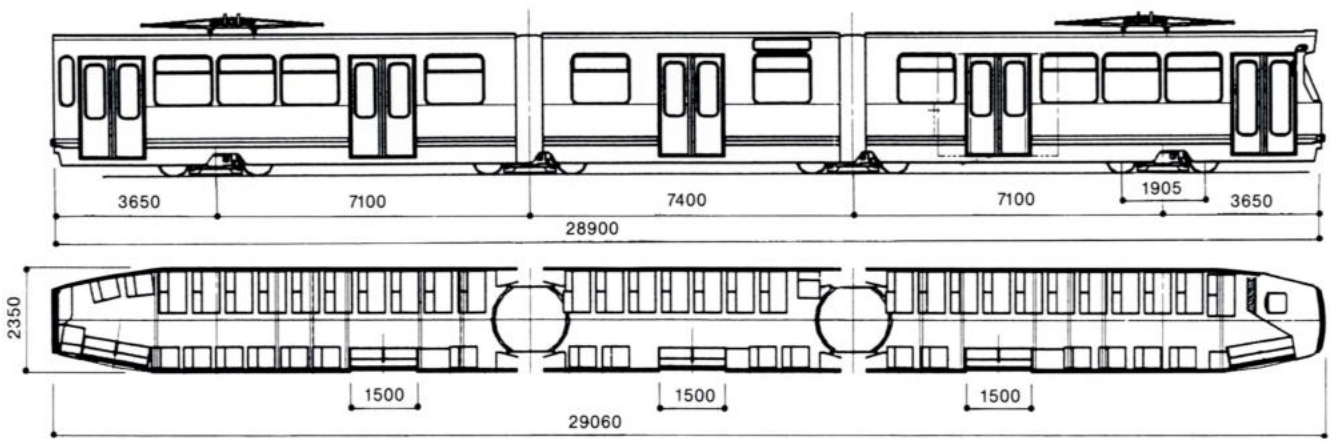
Propulsion system and electrical auxiliaries

(designed and realized by HOLEC, The Netherlands)
Power supply: 600 V d.c. overhead wire.
Motor power : 8 x 37 kW (cont. rating).
d.c. chopper control with electrodynamic and regenerative braking. Two separate traction units.
Auxiliaries 24 V d.c.

Brake equipment

Service braking : electrodynamic and regenerative.
Parking brake : friction brake system with 8 drums; hydraulically operated.
Emergency : supplemented with 8 electro-magnetic track brakes.

100 Light Rail Vehicles have been operated by HTM (Urban Transportation Company of The Hague) since 1981. 47 additional vehicles are being delivered.



8-axle double articulated light rail vehicle for the city of The Hague, The Netherlands.

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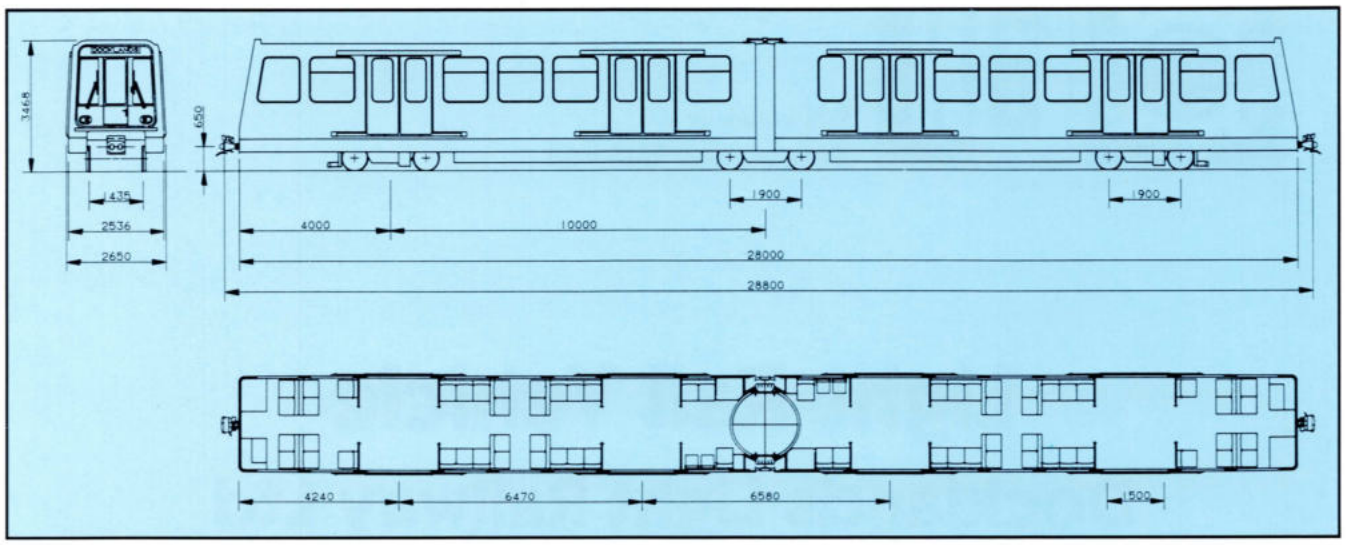
Light Rail Vehicle

Docklands Light Railway Ltd
London

Photos : E. Beerlandt



Main features

Track gauge	1.435 m
Length	28.000 m
Length over coupler	28.800 m
Width over doors	2.650 m
Floor height	1.025 m
Overall height	3.468 m
Wheel diameter, new/worn	740/660 mm
Doors : number per side	4 double
type	outside sliding
free opening	1.500 m
Weight empty	36 t
Number of seats	66
(not including 4 tip-up seats)	
Standees (6 p/m²)	218
Total capacity	284

Performance

Maximum service speed	80 km/h (50 mph)
Acceleration rate	1.1 m/sec² average
Service deceleration rate	1.3 m/sec²
Minimum curve radius	38 m

Carbody

The body is steel-welded. The steel has anti-corrosion properties. A door is provided at the front and end. The two cars are connected by a BN patented wide passage articulation with full passenger protection and anti-vandalism design. The vehicle design complies with the fire protection regulations applying for tunnel operations.

Bogies

2 BN monomotor bogies.
1 BN trailer bogie under articulation.
Rubber primary and air spring secondary suspension.
Disc brake.
Axle bearing inside wheels.

Traction

Supplied by BEM (Brush Electrical Machines Ltd)
Power supply : 750 V d.c. third rail.
Motor power (continous rating) : 2 x 140 kW.
2 DC chopper control units.
Electrodynamic brakes with resistor or regenerative.

Mechanical brakes

Disc brakes; air applied for service brake, spring applied air released for parking brake.

ATO/ATP

ATO supplied by WBS (Westinghouse Brake and Signal Ltd) and ATP supplied by GEC for the 23 first vehicles, ATO/ ATP equipment supplied by Alcatel (Canada) for the remaining 47.
The ATO equipment operates the vehicle automatically by means of an on-board computer without any human intervention.
The ATP equipment and the signalling system ensure the safety operations.

Auxiliary equipment

750 V d.c. / 28 V d.c. static convertor.
Heating system : supplied by WBS
Doors and door mechanisms : supplied by WBS

The 70 Light Rail Vehicles ordered by DLR are manufactured by BN Belgium in collaboration with HSRP (U.K.). The cars are operated and monitored fully automatically without driver by an on-board computer and a sophisticated track signalling system.
These cars will cover the growing demand in the field of transport in the Docklands due to the development of the Dockland area and to the opening of the Bank and the Beckton extension.

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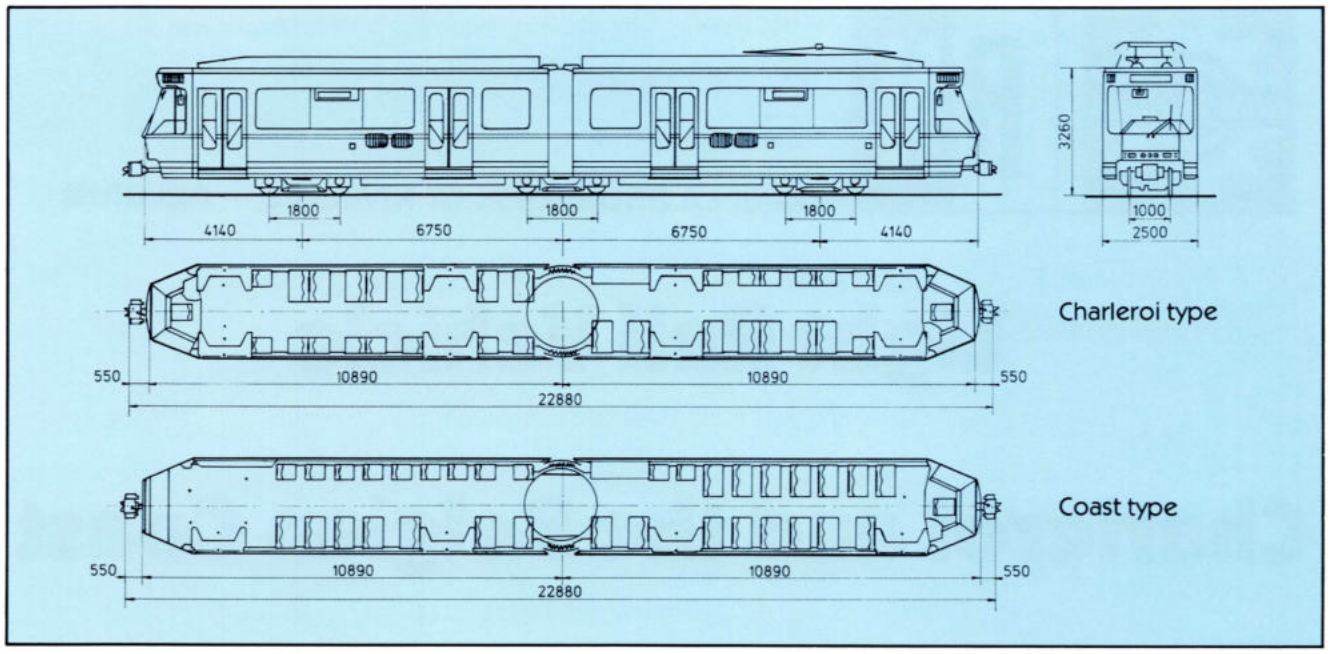
BOMBARDIER BN

FORMERLY LA BRUGEOISE ET NIVELLES - BELGIUM

Light Rail Vehicle

Charleroi and the Belgian Coast



105 6-axle light rail vehicles have been delivered to the SNCV (Société Nationale des Chemins de Fer Vicinaux).

General characteristics

Track gauge	: 1.000 m
Overall length	: 22.880 m
Body length	: 21.780 m
Total width	: 2.500 m
Floor height	: 0.860 m
Height, rail to roof	: 3.260 m
Wheel diameter, new	: 0.660 m
Doors - number	: * 4 double/8 double
- type	: folding
- width, open	: 1.200 m
Weight, empty	: * 34.250 T/35.000 T
Number of seats	: * 59/44
Standing passengers (6 pass/m²)	: * 132/148
Total passengers	: * 191/192

Performance characteristics

Max. service speed	: * 75/65 k.p.h.
Acceleration	: 0.98 to 1.35 m/s² according to loading conditions
Average decelaration	: 1.35 m/s²
Emergency deceleration	: 2.8 m/s²

Articulation

1 BN articulation with access passage of 1.66 m

Bogies

2 BN single-motor bogies at car ends
1 BN trailer bogie under the articulation

Electrical system

Nominal line voltage	: 600 V DC
Motor power	: 2 x 228 kW

Traction equipment with thyristor chopper control (ACEC Belgium)

Brake equipment

3 types of brakes:
- electrodynamic on the motor bogies
- electropneumatic on the 3 bogies
- track brakes on the 3 bogies.

50 BN light rail vehicles, with one driving cab and doors on one side only, are presently operating on a 60 km coastal route linking the different cities on the coast.

55 double-ended vehicles are being provided for the Charleroi urban transport network. They are to travel in mixed traffic, on segregated ways, on viaducts or underground, according to local requirements.

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Light Rail Vehicle
Manila

BN division of
Bombardier Eurorail

General characteristics

Track gauge	1.435 m
Body length	29.280 m
Total width	2.500 m
Floor height	0.900 m
Height, rail to roof	3.272 m
Wheel diameter, new	0.660 m
Doors : number	5 double (on both sides)
type	"BN" swing plug
opening	1.300 m
Empty weight	41 t
Number of seats	81
Standing passengers	293 (7 pass/m²)
Total passengers	374

Performances

Max. service speed	60 km/h
Acceleration (7 pass/m²)	1 m/s²
Average service deceleration (7 pass/m²)	1.3 m/s²
Average emergency deceleration (7 pass/m²)	2.08 m/s²
Minimum horizontal radius	25 m

Articulation

2 BN patented articulations with access passage of 1.66 m, full passenger protection, and anti-vandalism design.

Bogies

2 BN monomotor bogies at car ends
2 BN trailer bogies under the articulations

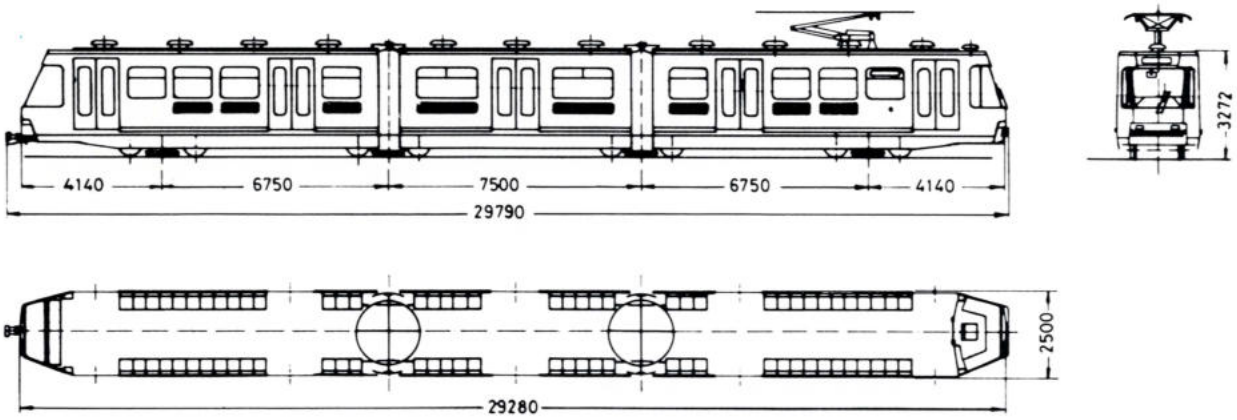
Electrical system

Nominal line voltage : 750 V
Motor power : 2 x 217.7 kW
Traction equipment with chopper control for regeneration of energy (ACEC Belgium)

Brake equipment

Electro-dynamic (rheostatic) brakes acting as service brake.
2 disc brakes per motor bogies acting as emergency and substitution brake
2 disc brakes per trailer bogie acting as service brake
2 electromagnetic track brakes per bogie for use in case of emergency.

BN Light Rail vehicles help the Manila Authorities to solve their city congestion problems. The vehicles operate in trains of 2 units (748 passengers) providing the line with a transport capacity of 20,000 passengers per hour in each direction. Later, by introducing trains of 3 vehicles (1,122 passengers) the capacity could be increased to 30,000 passengers per hour in each direction.



8-axle articulated light rail vehicles operated in Manila in trains of 2 units

BN division of
Bombardier Eurorail

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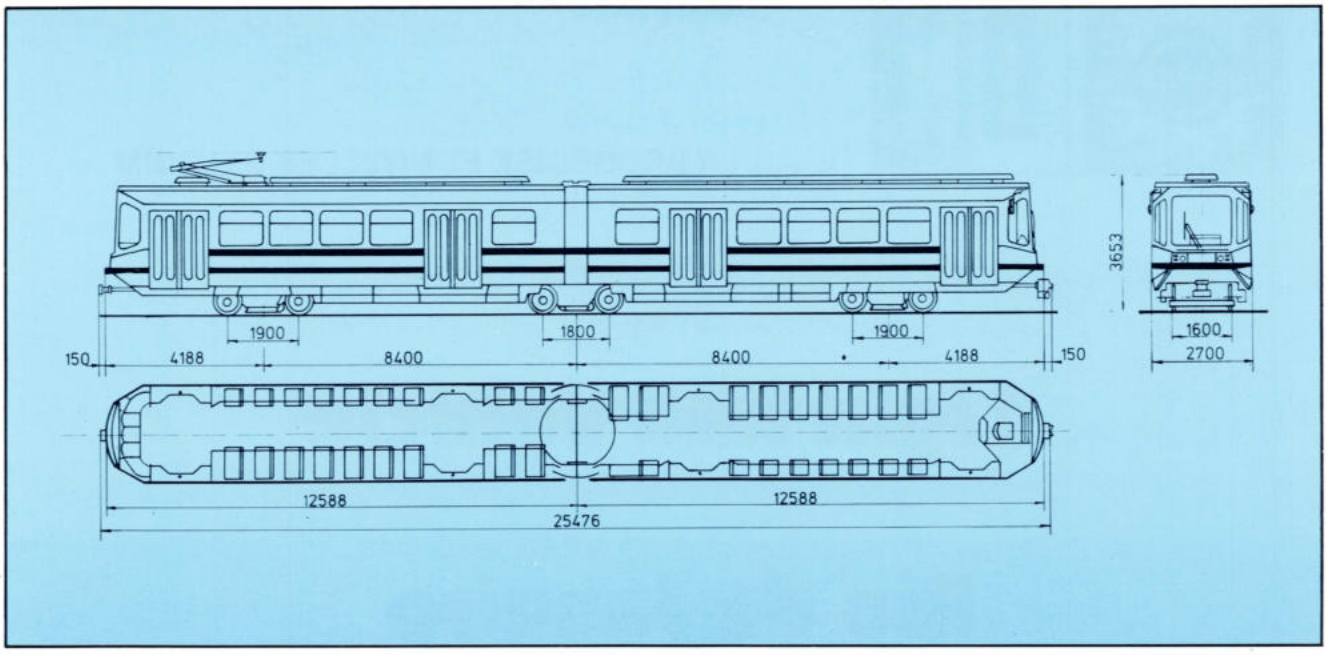
BOMBARDIER BN

FORMERLY LA BRUGEOISE ET NIVELLES-BELGIUM

Light Rail Vehicle

Rio de Janeiro



6-axle articulated light rail vehicles for the city of Rio de Janeiro, designed to run in 4-unit trains.

General characteristics

Track gauge	: 1.600 m
Body length	: 25.476 m
Total width	: 2.700 m
Floor height	: 0.950 m
Height, rail to roof	: 3.400 m
Wheel diameter, new	: 0.680 m
Doors - number	: 4 double
- type	: bifolding
- width, open	: 1.350 m
Weight, empty	: 38.360 T
Number of seats	: 58
Standing passengers (6 pass./m²)	: 193
Total passengers	: 251

Performance characteristics

Max. service speed	: 80 k.p.h.
Acceleration	: 1 m/s²
Average service deceleration	: 1.2 m/s²
Average emergency deceleration	: 1.5 m/s²
Minimum horizontal radius	: 25 m

Articulation

1 BN patented articulation with access passage of 1.74 m, full passenger protection and anti-vandalism design.

Bogies

2 single-motor bogies (MTE type)
1 trailer bogie (MTE type) under the articulation.

Electrical system

Nominal line voltage : 750 V
Motor power : 2 x 200 kW
Traction equipment "Siemens/BBC" with resistors switched by electro-magnetic contactors.
Current collector : pantograph and 3rd rail
Automatic coupler BSI.

Brake equipment (Knorr)

2 disc brakes per single-motor bogie
2 disc brakes per trailer bogie (service brake)
6 independent suspended track brakes

68 light rail vehicles have been ordered by Companhia do Metropolitano do Rio de Janeiro for the Rio network.
8 vehicles have been built in the BN workshops and 60 vehicles manufactured by Cobrasma Sumaré S.A., under licence from BN, are now being delivered.

N.V. BOMBARDIER BN S.A. Rue Montoyer 10 Montoyerstraat – B-1040 BRUSSELS - BELGIUM – Tel. 32/2/511 39 60 – Telex 61.376 – Fax : 32/2/511.72.47

LIGHT RAIL VEHICLES (LRV)

TECHNICAL DATA

CITY / COUNTRY		RIO DE JANEIRO BRAZIL	THE HAGUE NETHERLANDS	CHARLEROI BELGIUM	BELGIAN COAST BELGIUM	MANILA PHILIPPINES	PORTLAND U.S.A.	AMSTERDAM STADSTRAM NETHERLANDS	AMSTERDAM SNELTRAM NETHERLANDS	LONDON DOCKLANDS UNITED KINGDOM
YEAR FIRST BUILDING		1979	1981	1981	1982	1983	1984	1989	1990	1990
NUMBER		68	100	54	49	64	26	45 (20 x 11G) (25 x 12G)	13	44
TRACK GAUGE	m	1.600	1.435	1.000	1.000	1.435	1.435	1.435	1.435	1.435
TARE WEIGHT	t	38.40	37.75	35.00	34.25	39.20	42.50	37.0	48.0	39.3
BODY LENGTH	m	25.476	28.5	21.78	21.78	29.79	26.51	25.63	30.08	28.80
BODY WIDTH	m	2.70	2.35	2.50	2.50	2.50	2.65	2.35	2.65	2.65
FLOOR HEIGHT	m	0.950	0.860	0.860	0.860	0.900	0.984	midsection 280 mm	1.100	1.025
ARTICULATIONS		1	2	1	1	2	1	2	1	1
BOGIES		3 (2 powered)	4	3 (2 powered)	3 (2 powered)	4 (2 powered)	3 (2 powered)	4	3	3 (2 powered)
MOTOR POWER (1 h)		2 x	8 x	2 x	2 x	2 x	2 x	8 x	6 x	2 x
		230 kW DC	42.5 kW DC	228 kW DC	228 kW DC	230 kW DC	210 kW DC	38.5 kW AC	77 kW AC	140 kW DC
MAXIMUM SPEED	km/h	80	70	65	75	60	88.5	70	70	80
AVERAGE SERVICE ACCELERATION	m/sec²	1.00	1.20	1.10	1.00	1.1	1.34	1.25	1.30	1.1
AVERAGE SERVICE DECELERATION	m/sec²	1.20	1.30	1.35	1.35	1.35	1.34	1.35	1.50	1.3
LINE VOLTAGE		750 V. DC	600 V. DC	600 V. DC	600 V. DC	750 V. DC	750 V. DC	600 V. DC	600 V. (catenary) 750 V (3rd rail)	750 V. DC
ACCOMODATION : SEATS		58	77	44	59	81	76	52 (11G) 63 (12G)	64	70
STANDEES (4/m²)		128	96	98	88	168	90	87 (11G) 91 (12G)	169	145
STANDEES (6/m²)		192	144	148	132	252	135	130 (11G) 136 (12G)	253	218
MINIMUM CURVE (RADIUS)	m	25	16	18	18	25	25	16.5	40	38
BRAKING SYSTEM		ELECTRO-PNEUMATIC	ELECTRO-HYDRAULIC	ELECTRO-PNEUMATIC	ELECTRO-PNEUMATIC	ELECTRO-PNEUMATIC	ELECTRO-HYDRAULIC	ELECTRO-HYDRAULIC	ELECTRO-HYDRAULIC	ELECTRO-PNEUMATIC
OPERATION		Unidirectional	Unidirectional	Bidirectional	Unidirectional	Unidirectional	Bidirectional	11G = bidirectional 12G = unidirectional	Bidirectional	Automated Bidirectional

LIGHT RAIL VEHICLES (LRV)

TECHNICAL DATA

CITY - COUNTRY		RIO DE JANEIRO BRAZIL	THE HAGUE NETHERLANDS	CHARLEROI BELGIUM	BELGIAN COAST BELGIUM	MANILA PHILIPPINES	PORTLAND USA	AMSTERDAM STADSTRAM NETHERLANDS	AMSTERDAM SNELTRAM NETHERLANDS	LONDON DOCKLANDS UNITED KINGDOM
YEAR FIRST BUILDING		1970	1981	1981	1982	1982	1984	1986	1990	1990
NUMBER		96	100	84	49	64	26	46 (20 x 7 (8) 26 x 1 (2))	12	44
TRACK GAUGE	m	1.000	1.435	1.000	1.000	1.435	1.435	1.435	1.435	1.435
TARE WEIGHT	t	35.4t	47.75	36.00	34.25	42.50	37.0	48.0	36.1	
BODY LENGTH	m	24.47	28.5	21.78	21.78	29.19	29.01	25.63	30.08	28.60
BODY WIDTH	m	2.70	2.65	2.50	2.50	2.50	2.65	2.35	2.65	2.65
FLOOR HEIGHT	m	0.95	0.850	0.860	0.860	0.900	0.984	Middle: 0.80 m	1.100	1.025
ARTICULATIONS		1	2	1	1	2	1	2	1	1
BOGIES		3	4	3	3	4	3	4	3	3
MOTOR POWER (kW)		2 x (2 powered)	6 x	2 x (2 powered)	2 x (2 powered)	2 x (2 powered)	2 x (1 powered)	6 x	8 x	2 x (2 powered)
		370 kW DC	425 kW DC	252 kW DC	230 kW DC	230 kW DC	210 kW DC	38.5 kW AC	77 kW AC	140 kW DC
MAXIMUM SPEED	km/h	80	70	55	75	80	88.5	70	70	80
AVERAGE SERVICE ACCELERATION	m/sec²	1.00	1.20	1.10	1.00	1.1	1.24	1.25	1.30	1.1
AVERAGE SERVICE DECELERATION	m/sec²	1.20	1.20	1.35	1.35	1.35	1.34	1.25	1.45	1.3
LINE VOLTAGE		750 V DC	750 V DC	600 V DC	600 V DC	750 V DC	750 V DC	800 V DC	750 V DC (Middle: 1.5 kV DC)	750 V DC
ACCOMODATION: SEATS		68	77	44	58	81	75	52 (116) (26 (120))	64	70
STANDEES (num)		128	96	88	88	188	90	67 (116) 91 (120)	169	142
STANDEES (sqm)		150	124	148	132	282	135	147 (116) 136 (120)	253	213
MINIMUM CURVE RADIUS	m	25	16	12	18	25	25	16.5	40	30
BRAKING SYSTEM		ELECTRO-PNEUMATIC	ELECTRO-HYDRAULIC	ELECTRO-PNEUMATIC	ELECTRO-PNEUMATIC	ELECTRO-HYDRAULIC	ELECTRO-HYDRAULIC	ELECTRO-HYDRAULIC	ELECTRO-HYDRAULIC	ELECTRO-PNEUMATIC
OPERATION		Manual	Driverless	Driverless	Driverless	Driverless	Driverless	Driverless (72 x Driverless 72 x Driver)	Driverless	Automatic Driverless

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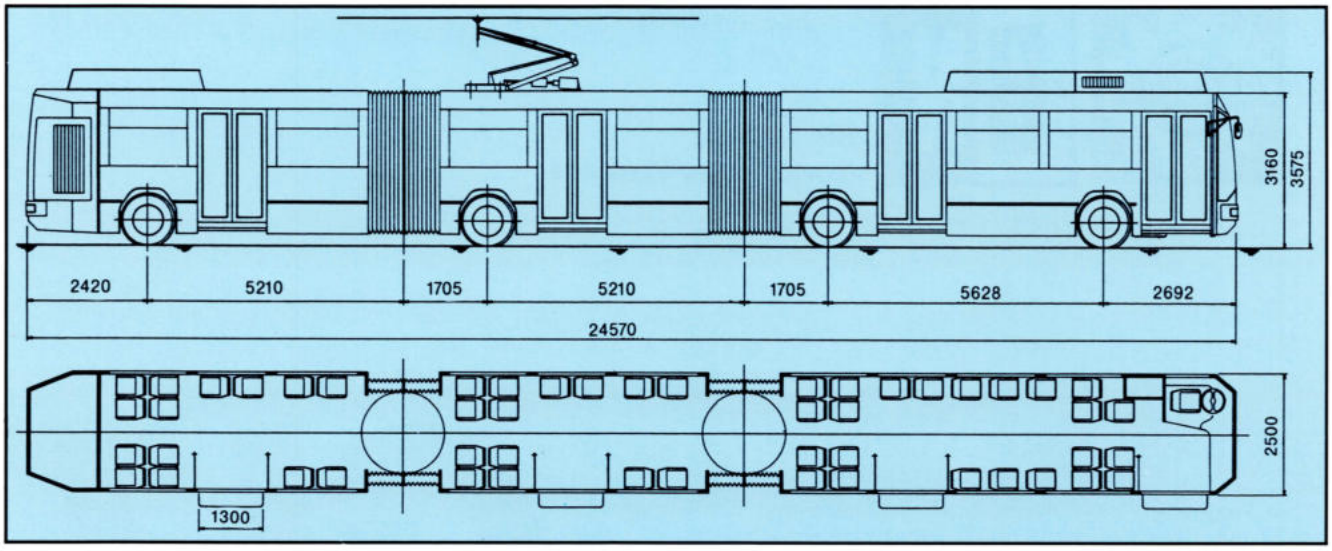
GLT

Guided Light Transit



The GLT (Guided Light Transit) is a new system for urban transport which has been developed and tested during many years in the context of a special R & D programme.

Its main characteristics are:

- Low cost mass transit system, reliable and safe, transporting passengers from suburban areas to the city centre without transfer.
- Bi-mode: it can be operated in guided, as well as in unguided mode, with electric power supplied by catenary, or alternatively by a built-in diesel generator.
- The vehicles are guided by a central rail, imbedded at surface level, each axle being steered within narrow tolerances by a patented guiding system.
- Low-noise vehicles, causing little pollution due to the use of pneumatic tires and electric power.
- The system can be operational from the very start, thus generating revenue for the operators, even prior to any investment in civil works.
- The vehicles are specially designed for any kind of urban and suburban traffic, e.g. on viaduct, in tunnel, on segregated or mixed right of way.
- Infrastructure facilities can be limited to locations of high density traffic.

TECHNICAL CHARACTERISTICS

Undercarriage in corten steel; aluminium car body	
Weight	
empty	26,000 kg
total	40,000 kg
Passenger capacity	198
seats	51
standees (6 pers/m²)	147
Traction	
2 electrical motors	360 kW
Power supply	
either by catenary	600 V d.c.
or by diesel-electric generator	260 kW
Performances	
Max. service speed	70 km/h
Max. acceleration	1.2 m/s²
Max. deceleration	5.5 m/s²
Gradeability	15 %
Minimum curve radius on rail and on road	12 m
Steering axles	4
Reversibility	
Automatic coupling	

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THE MODULAR SUBURBAN CAR

This car is designed for use in large urban areas with high travel demand. It meets the general requirements of modern, comfortable, and economical urban and suburban transport.

Many different combinations based on the concept of standardisation and modularity ensure an appropriate solution for any specific demand.

HEAVY RAIL VEHICLES

From 1976 to 1982, BN delivered 80 double-unit metrocars to the Brussels Mass Transit Authorities (STIB).

The Brussels metrocar has an aluminium body-shell with unpainted brushed side walls. The body assembly concept is characterized by the use of profiles and rivets, plus overall modularity, which enables rapid and efficient assembly.

The rivetting technique is based on technology from the aircraft industry, while the driving cab arrangement and the passenger-seat design result from ergonomic studies.

As from 1991, BN will convert 32 double units into triple ones by adding a motorized mid-section.

TRAMWAYS

Tram travel is popular in Belgium where the earliest tramcars were built in our workshops in 1885. Among the numerous tramways exported by the company, the first went to Athens in 1907, and in 1922 double-deck trams were ordered by the city of Valparaiso, Chile.

Over the years, tramway systems have continued to be developed. Thus, for example, the first trams mounted on bogies began to operate in 1922. In 1947, BN bought the american P.C.C. (President Committee Car) licence for construction of an all-electric tramway. Without wasting time, a prototype was built the same year. Since then, four generations of vehicles have been developed.

Type 7900 double-articulated vehicles were delivered to the STIB in 1977 for use on the Brussels pre-metro system. This project is a link between the old TRAMWAYS and the LIGHT RAIL TRANSIT concept.

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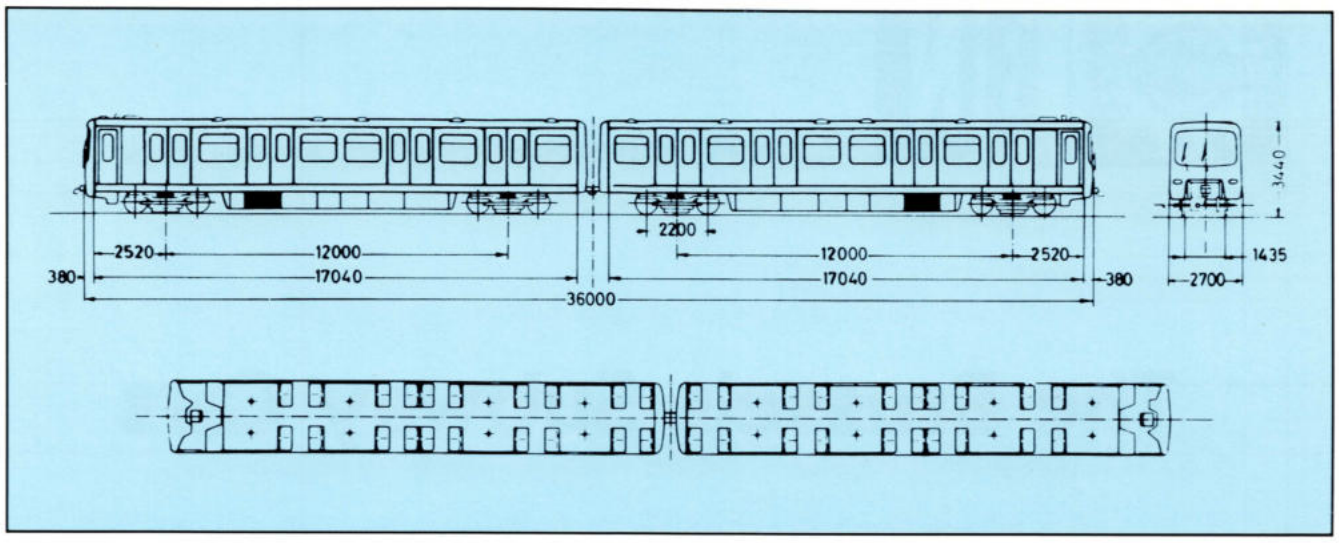
The Brussels Subway Cars



TECHNICAL CHARACTERISTICS OF THE TRACTION UNIT (2 CARS)

General characteristics

Track gauge	: 1.435 m
Length	: 36.000 m
Total width	: 2.700 m
Height,	
rail to roof	: 3.440 m
Doors :	
number	: 8 double
type	: sliding plug
opening	: 1.300 m
Empty weight	: 62 T
Number of seats	: 80
Standing passengers	: 340
Total passengers	: 420

Performance characteristics

Max. service speed	: 72 km/h
Acceleration	: 1.16 m/s^2
Service deceleration	: 1.10 m/s^2
Emergency	
deceleration	: 1.70 m/s^2

Bogies

4 monomotor bogies
Self-ventilated, fully suspended motors
Motorpower : 4 x 266.2 kW
Primary suspension by rubber elements
Secondary pneumatic suspension, with levelling valve.

Electrical system

Nominal line voltage : 750 V
Traction equipment with chopper control
for regeneration of energy (ACEC, Belgium)
Current collector : third rail

Brake equipment

Electro-dynamic (rheostatic) brakes acting as service brake.
2 disc brakes per bogie acting as emergency, substitution, parking and immobilizing brake.
2 electromagnetic track brakes per bogie for use in case of emergency.

The traction unit consists of two cars permanently coupled. BN has delivered 80 double-unit metrocars to the Brussels Mass Transit Authorities (STIB, Société des Transports Intercommunaux de Bruxelles).
The Brussel's metrocar has an aluminium body-shell with brushed and unpainted sidewalls.
The body assembly concept is characterized by the use of profiles and rivets for the joining techniques and its modularity for the manufacturing aspect.
The rivetting technique is based on the technology used and experienced in the aircraft industry.
The driver's cab arrangement and the passengers seat design result from ergonomic studies.
As from 1991, BN starts supplying 32 motorized intermediate cars, enabling STIB to operate 32 metrocar sets as triple units.

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LOCOMOTIVES

The first steam locomotive left our workshops in 1849 and, by 1910, we were able to exhibit our 1,000th model at the Brussels Universal Exhibition.

Our first electric rail locomotive made its appearance in 1927.

Since 1950, our Nivelles plant has been engaged in the construction of diesel-hydraulic and diesel-electric locomotives, many of which are exported to Bolivia, Zaïre, Angola, India, and Argentina. Turkey, Korea and Vietman have also been importing our locomotives over the past decade.

But our principal customer is Belgian National Railways (SNCB) which operates a large number of electric and diesel-electric locomotives built in our workshops.

ELECTRIC MULTIPLE UNITS (EMUs)

During the Second World War, the Nivelles plant produced the first prototype of a double electric unit. Since then several generations of EMUs have been manufactured. In 1976, an important series of quadruple electric units was built.

Among the most recent products, BN has delivered to SNCB 140 two-car units of a new EMU generation, known as type AM80, and to

Moroccan National Railways (ONCF) 8 three-car units derived from the AM80 type and operating as six-car sets at 160 km/h. Another of 6 units will be delivered in 1992.

The newest derivation, named type AM 86, is in production as from 1987 for SNCB.

Indonesian Railways ordered 7 four-car EMUs for delivery starting in 1992.

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Main line electric locomotives recently supplied to the Belgian National Railways (S.N.C.B.)

TECHNICAL DATA

CLASS	LOCO 27	LOCO 21	LOCO 11	LOCO 12
YEAR FIRST BUILDING	1981	1984 1987	1985	1986
NUMBER	60	30 30	12	12
TRACK GAUGE	1.435 m	1.435 m	1.435 m	1.435 m
CLEARANCE	UIC 505	UIC 505	UIC 505	UIC 505
MASSA	84 T	84 T	84 T	84 T
MAXIMUM SPEED	160 km/h	160 km/h	160 km/h	160 km/h
AXLE ARRANGEMENT	BoBo	BoBo	BoBo	BoBo
GEAR RATIO	1 : 2.829	1 : 3.742	1 : 3.742	1 : 3.742
WHEEL DIAMETER (new)	1,250 mm	1,250 mm	1,250 mm	1,250 mm
VOLTAGE SUPPLY	3 kV dc	3 kV dc	3 kV dc 1.5 kV dc	3 kV dc 25 kV-50 Hz ac
POWER - ONE-HOUR - CONTINUOUS	4,380 kW 4,180 kW	3,310 kW 3,125 kW	3,310 kW 3,125 kW	3,310 kW 3,125 kW
RATED SPEED - ONE-HOUR - CONTINUOUS	88.6 km/h 88.2 km/h	70.4 km/h 71.8 km/h	71.8 km/h 73.5 km/h	70.4 km/h 71.8 km/h
TRACTIVE EFFORT - ONE-HOUR - CONTINUOUS	177.5 kN 166.3 kN	165 kN 152 kN	161.8 kN 149.2 kN	165 kN 152 kN
STARTING EFFORT	234 kN	234 kN	234 kN	234 kN
EFFORT AT 160 km/h	78 kN	44 kN	44 kN	44 kN
MAXIMUM CATENARY CURRENT DEMAND	1,700 A	1,300 A	1,300 A	1,300 A
SERVICE	Belgium	Belgium	Belgium/ Netherlands	Belgium/ France

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ELECTRIC MULTIPLE UNITS (EMU's)

TECHNICAL DATA

TYPE	A4 QUADRUPLE	AM 80 DOUBLE	A3 TRIPLE	AM 86 MOTORCAR	AM 86 TRAILER
				2nd Class	1st+2nd Class
YEAR FIRST BUILDING	1975	1981	1983	1987	1991
NUMBER	44	140	8	35	17
TRACK GAUGE	1435 mm	1435 mm	1435 mm	1435 mm	
OVERALL LENGTH	99.03 m	50.85 m	75.81 m	52.80 m	
OVERALL WIDTH	2.98 m	2.90 m	2.90 m	2.808 m	
FLOOR HEIGHT	1.265 m	1.265 m	1.265 m	1.265 m	
TARE WEIGHT	216 t	105 t	145 t	60 t	46 t
ACCOMODATION: SEATS	1st class: 56 2nd class: 302	1st: 32 2nd: 139	1st: 32 2nd: 239	1st: 16 2nd: 72	24 63
STANDEES: (5 p/m^2)	140	54	84	30	50
BOGIES	8	4	6	4	
TENSION	3000 V. DC	3000 V. DC	3000 V. DC	3000 V. DC	
POWER	1500 kW	1240 kW	1416 kW	690 kW	
SERVICE ACCELERATION	0.50 m/sec^2	0.75 m/sec^2	0.53 m/sec^2	0.55 m/sec^2	
SERVICE DECELERATION	0.75 m/sec^2	0.75 m/sec^2	0.75 m/sec^2	0.75 m/sec^2	
BRAKING SYSTEM	OERLIKON EST 4 d/RBE BSI Disk Brake + Shoe Brake	OERLIKON UTB Electro-Pneumatic + Dynamic SAB Disk Brake + Shoe Brake	OERLIKON UTB Electro-Pneumatic SAB Disk Brake + Shoe Brake	OERLIKON EST 303 Electro-Pneumatic Disk Brake	
MAXIMUM SPEED	140 km/h	160 km/h	160 km/h	120 km/h	
SERVICE	BELGIUM	BELGIUM	MOROCCO	BELGIUM	

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Main Line Electric Locomotive

Type 11

Dual-voltage locomotive for both freight and passenger rapid transit

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GENERAL CHARACTERISTICS

Track gauge	1,435 mm	
Axle arrangement	BoBo	
Number of traction motors	4	
Weight	84 T	
Maximum speed	160 km/h	
Half-worn wheel diameter	1,215 mm	
Gear ratio	1 : 3.742	
Rated voltage	3 kV - 1.5 kV d.c.	
Clearance	UIC 505	
	One-hour rating	Continuous rating
Power (acc. to IEC)	3.310 kW	3.125 kW
Rated speed	71.8 km/h	73.5 km/h
Tractive effort at wheels	161.8 kN	149.2 kN
Maximum starting effort	234 kN	
Effort at 160 km/h	44 kN	
Maximum catenary current demand	3 kV : 1,300 A 1.5 kV : 2,600 A	

TECHNICAL FEATURES

Duo-voltage locomotive

The locomotive type 11 makes the link between Belgium and The Netherlands.
Its is able to operate with a line voltage of 3 kV or 1.5 kV d.c.

Traction

Maximal adhesion due to transmission of the tractive effort via a low-slung traction link.
Tractive effort and speed regulation by means of thyristor choppers.
Reduced force between wheels and track through use of fully suspended motors and elastic lateral suspension of axles.

Braking

Dynamic braking electronically coupled with pneumatic braking.

Aluminium

Non-load-bearing parts such as doors, partitions, facings and roofing are made of extruded aluminium.

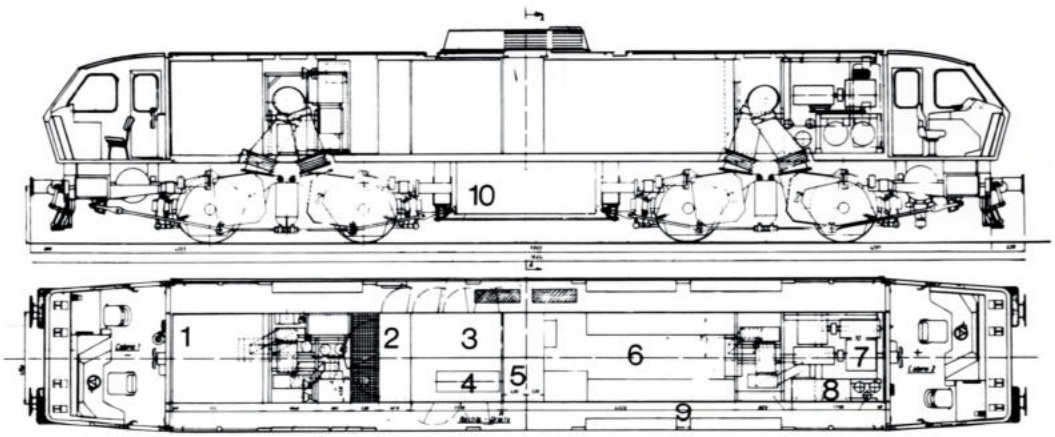
Modularity

The modular design of the cabs and of the electric and pneumatic equipments located in the body reduces maintenance time.
The integrated pneumatic panel allows units to be fitted and removed without interfering with piping.

Driver safety and comfort

Ensured by ergonomic driving position, heating and ventilation with air renewal, bogie suspension.

Locomotive type 12 (3kV - 25 kV d.c.) presenting the same general characteristics makes the link between Belgium and France.



1. Static converters
2. Low voltage cubicle
3. High voltage cubicle
4. High-speed circuit-breaker
5. Dynamic braking resistors
6. Choppers
7. Motor-compressor sets
8. Pneumatic equipment
9. Battery box
10. Smoothing coil

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type AM 89
3 kV D.C. electric multiple units
for the Belgian National Railways

BN division of
Bombardier Eurorail

GENERAL CHARACTERISTICS

		MOTOR COACH	TRAILER
Overall length	m	26.400	26.400
Overall width	m	2.800	2.800
Height	m	3.960	3.960
Centre distance of bogies	m	19.125	19.125
Floor height, above rail	m	1.265	1.265
Doors : sliding plug door			
clear width	m	1.300	1.300
Seats : 1st Class		16	24
2nd Class		72	63
Total of passengers including standees at 5 pass./m²		118	137
Tare weight	kg	59.000	47.400

Coupling : automatic front coupler GF
between coaches UIC Standard

Heating and ventilation system :

power 39.6 kW
heating/ventilation 30 renewals/h

Performances :

Maximum speed	120 km/h
Acceleration at normal load	0.55 m/sec²
Deceleration	0.75 m/sec²
Motor power (continuous rating)	690 kW

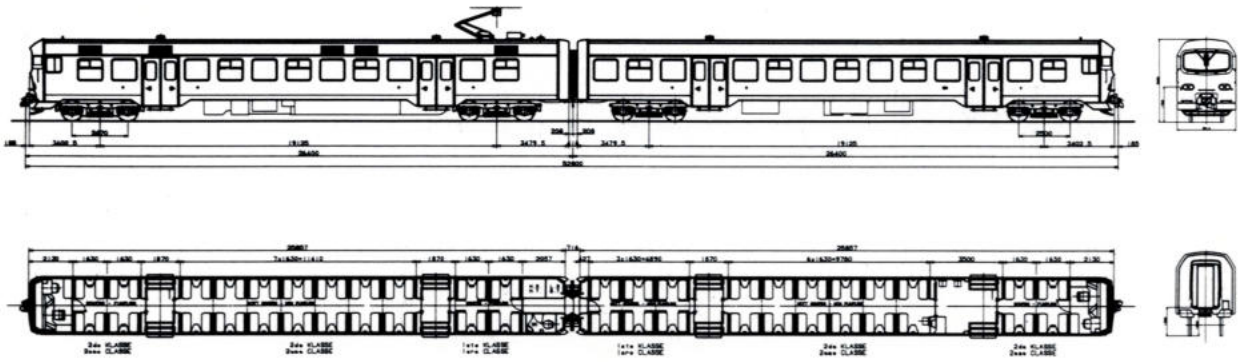
Bogies :

Type : motor coach and trailer SCHLIEREN
Secundary suspension coil spring
Track gauge 1,435 mm
2 motor bogies and 2 trailer bogies
Wheel base :
motor bogie 2,670 mm trailer 2,500 mm
Wheel diameter :
motor bogie 1,010 mm trailer 1,010 mm

Brake system :

Type : Oerlikon ESt3
Electro-pneumatic friction brake system
with 2 disk-brakes per axle.
Disk braking only
Disk diameter : motor coach Ø 820 mm
trailer Ø 700 mm
Electronic anti-skid system
Air-operated emergency brake.
Parking brake : on one bogie per coach.

Electrical motor unit meeting UIC recommendations.
A "one-man car" service is possible (pneumatically operated rear view mirrors installed on both sides of the driver's cab).
Built up from standard modules (passenger or technical compartments).
Accomodation for wheelchairs on one platform.
Application of GRP for outside lining, reducing maintenance and risk of corrosion.
35 2-car sets were delivered in 1988-89 on (named AM 86). The production of a further 17 sets' order (code named AM 89) has been completed in 1992.



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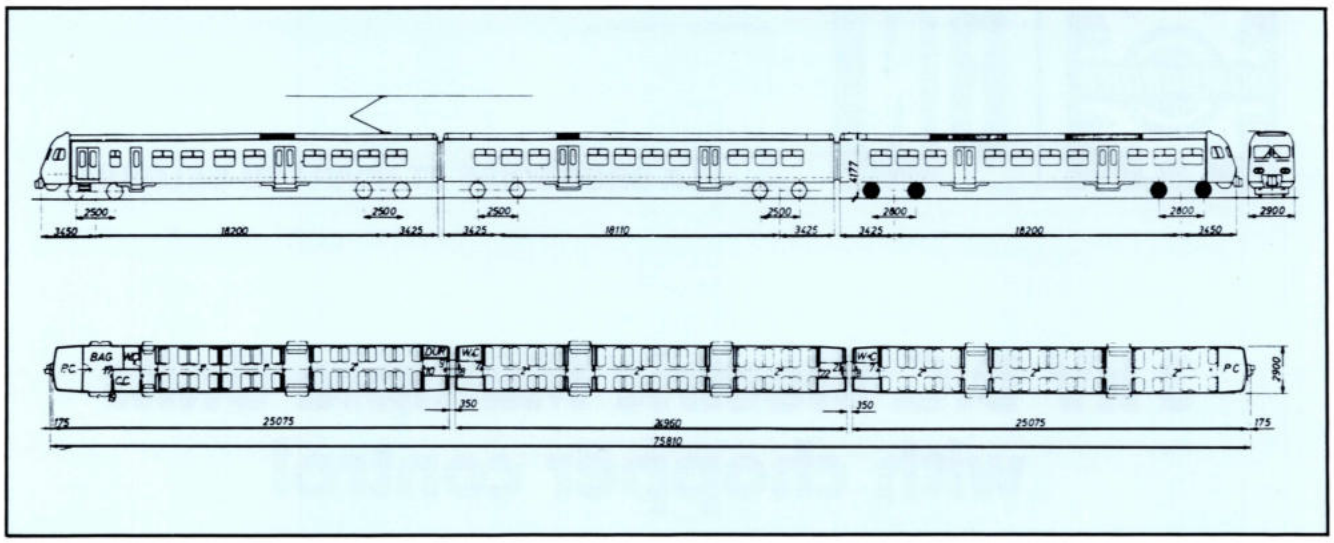
FORMERLY LA BRUGEOISE ET NIVELLES-BELGIUM

3 kV D.C. Electric Multiple Units with chopper control

for the Moroccan National Railways (ONCF)



Three-car traction unit designed for the ONCF

TECHNICAL CHARACTERISTICS OF THE TRACTION UNIT*

General characteristics

Track gauge	: 1.435 m
Weight, empty	: 145 T
Floor height	: 1.265 m
Length	: 75.810 m
Width	: 2.900 m
Number of seats	
1st class	: 32
2nd class	: 239
Standing passengers	
1st class	: 9
2nd class	: 75
Total passengers	: 355
Outward swinging plug doors	
Opening	: 1.260 m

Safety and comfort

Heating
20 airenewals/hour
Ventilation
40 airenewals/hour
Interphony system
Automatic Train Stop
Automatic coupler

Performance characteristics

Max. service speed	: 160 km/h
Acceleration	: 0.53 m/s²
Deceleration	: 0.75 m/s²
Power	: 1,416 kW

Bogies

WEGMANN WTR type
2 bimotor bogies
4 trailer bogies
Secondary pneumatic suspension

Motors

4 fully suspended motors
Chopper control equipment for regeneration of energy.

Brake equipment

Service braking: electropneumatic
2 disc brakes/axle
1 shoe brake/wheel
Emergency braking: pneumatic

* The traction unit consists of a motorized car with driving-cab, an intermediate trailer car and a trailer car with driving-cab.

Eight three-car units have been ordered by the Moroccan National Railways (ONCF).
These EMU's are operating in trains of 2 traction units (6 cars) on the new electrified line linking Rabat to Casablanca at the speed of 160 km/h.

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COACHES

The earliest rail coaches were built at Familleureux in 1900 and at Brugge in 1905. They were of wooden construction.

Since then, coaches have witnessed continuous development, and production of the new M4 and RIC coaches is the result of continuous and intensive collaboration between BN and SNCB technical departments.

Similary, the succesful M5 Double-Deck coaches, in production since 1985, are the culmination of very close cooperation between BN and its customers.

WAGONS

The company manufactured its first wagons in 1875, at Manage.

After the Second World War, BN diversified production by constructing special wagons. In the 1950s, the firm introduced a major scheme of rationalization by adopting the continuous assembly-line system known in Brugge as the "Tunnelsyteem". By this method, a single wagon can be completed every 26 minutes!

The number of wagons constructed and exported to all parts of the world runs into tens of thousands, and innovations in this field are still being pursued by the creation of special-purpose wagons.

End 1989, BN - as member of the Euroshuttle Consortium - obtained the contract for the delivery as from 1992 of 126 special shuttle wagons of the single deck "Tourism" design, measuring 25 x 4.5 x 5.6 m. The body shells are made of stainless steel.

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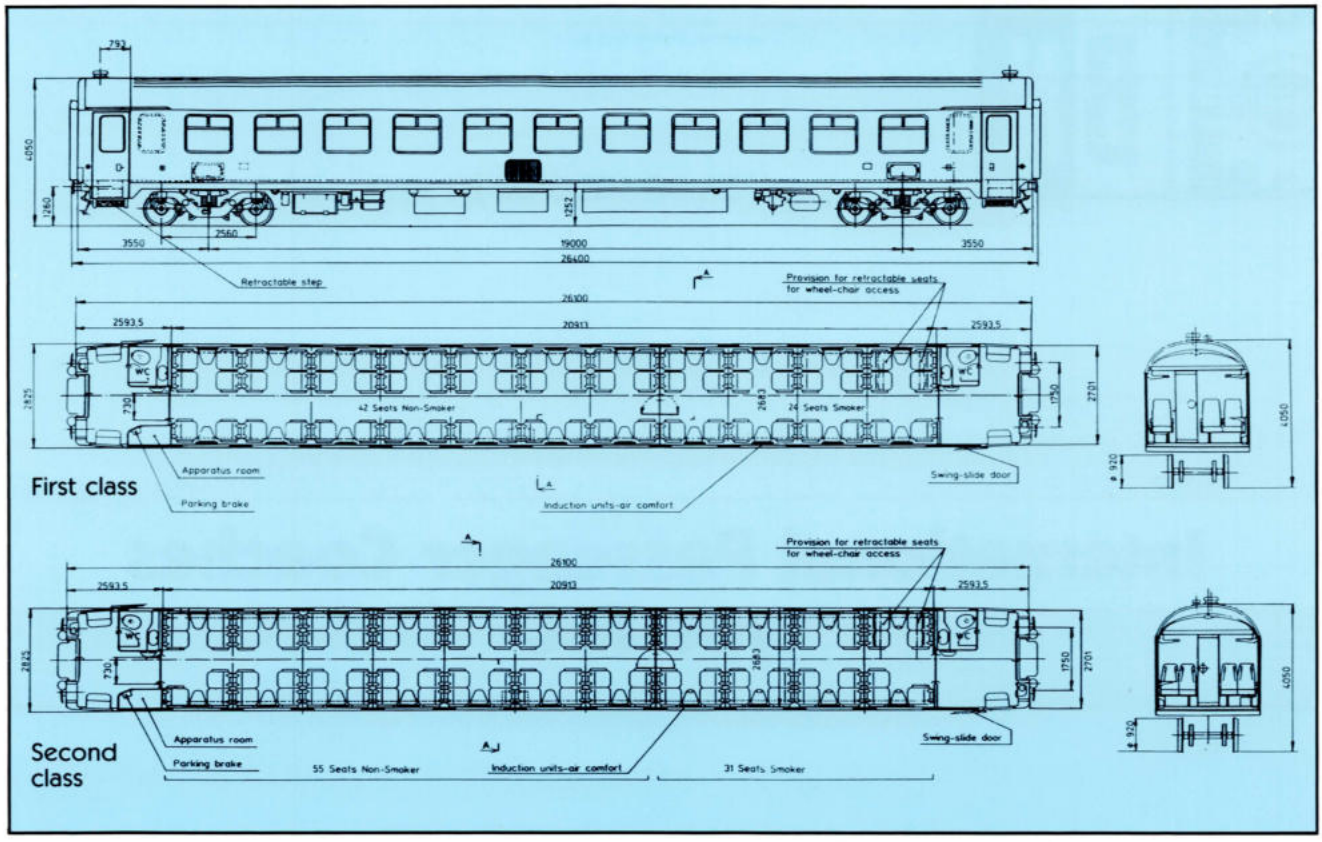
International Passenger Coaches type RIC



TYPE Kinematic gauge UIC 505		A 1st class	B 2nd class
Overall length	m	26.400	26.400
Overall width	m	2.825	2.825
Height	m	4.040	4.050
Bogie pivot pitch	m	19.000	19.000
Bogie wheel base	m	2.560	2.560
Height floor above rail	m	1.250	1.250
Swing slide doors: clear width	mm	800	800
Number of seats		66	86
Tare weight	t	41	41/42.6*
Power convertor	kW	11.4	11.4/35*
Power supply: as per RIC regulations			
Heating and ventilation system	kW	39.6	39.6
Airconditioning	kW		35*

* Coaches with airconditioning

Max. speed		160 km/h
Max. speed with adapted brake system		200 km/h

BOGIE

– type		FIAT 0270
– secundary suspension		coil spring
– disc brake	mm	Ø 610
Wheel diameter new/worn	mm	920/870
Wheel type		monobloc
Track gauge	mm	1435
Brake		disc brake

BRAKE EQUIPMENT

- electro-pneumatic friction brake system with 2 disc-brakes per axle
- electronic anti-skid system according to latest UIC specifications
- air operated emergency brake
- parking brake on one truck per coach
- brake system KE2d/SL/DE-EPZ6

- Saloon coach with bi-directional seating arrangement.
- Coaches in accordance with UIC and RIC prescriptions.
- All lining materials comply with SNCB, SNCF, UIC requirements concerning inflammability.
- Accomodation for wheelchairs in compartment.

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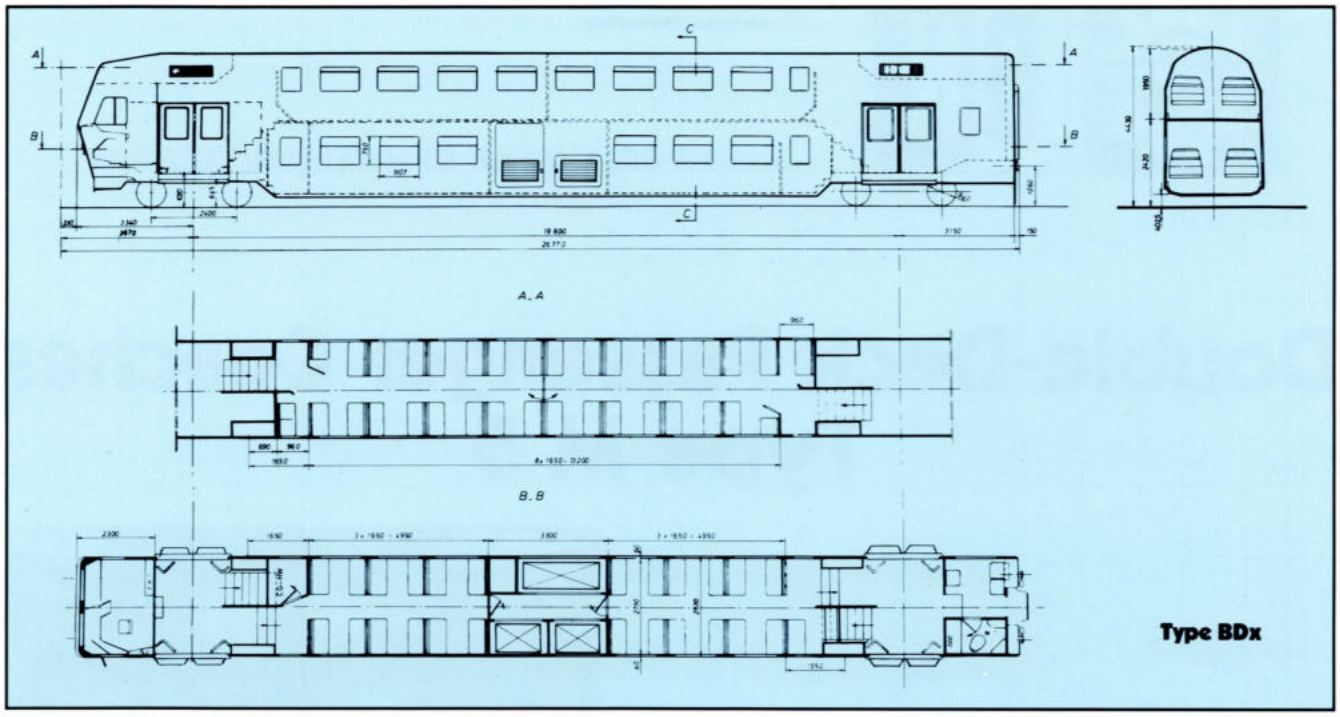
FORMERLY **LA BRUGEOISE ET NIVELLES-BELGIUM**

Double-Deck Passenger Coaches Type M 5



TYPE		BDx 2nd clas with driver's cab	B 2nd clas	A 1st class
Overall length	m	26.770	26.400	26.400
Overall width	m	2.830	2.830	2.830
Height	m	4.430	4.430	4.430
Centre distance of trucks	m	19.800	19.800	19.800
Truck wheel base	m	2.500	2.500	2.500
Wheel diameter	mm	840	840	840
Height of floor above rail				
– lower level	m	0.405	0.405	0.405
– upper level	m	2.423	2.423	2.423
– door treshold	m	1.050	1.050	1.050
Height under ceiling				
– lower compartment	m	1.953	1.953	1.953
– upper compartment	m	1.950	1.950	1.950
Swing plug doors : width	m	1.800	1.800	1.800
Number of seats		121	146	142
Number of seated passengers and standees (5 p/m²)		330	370	360
Tare weight	T	49	44	45

Max. speed	140 km/h
Track gauge	1,435 mm
Power converter ACEC	65 kVA
Line voltage (in-out)	3,000 V d.c./380 V a.c. 24 V d.c.
Brake system	Oerlikon ESt3f
Disc brakes	Ø 640 mm

TRUCKS

- type : Y 36 P
- secondary air suspension

Brake equipment

- electro-pneumatic friction brake system with 2 disc-brakes per axle
- variable load system controls brake cylinder pressure
- electronic anti-skid system according to latest UIC specs
- air operated emergency brake
- parking brake on one truck per coach

DESIGN-COMFORT-SAFETY

New generation of double-deck coaches for the Belgian Railways.
The lower compartment of the BDx coach includes two enclosed technical cabinets and a compartment for the guard. The ergonomically designed driver's cab at the end of he BDx coach is equipped with energy absorbers and a 3-layer laminated safety-windshield.
All internal materials comply with S.N.C.B., S.N.C.F.,- requirements concerning inflammability.
Technical cabinets are made of fire retardant materials.
Exterior doors are outside swinging plug doors with a width of 1.800 m.
Aircomfort system : – heating installation with 20 renewals per hour
(recirculation of air when heating up the car or by very cold weather)
– ventilation with 40 renewals per hour during summer.

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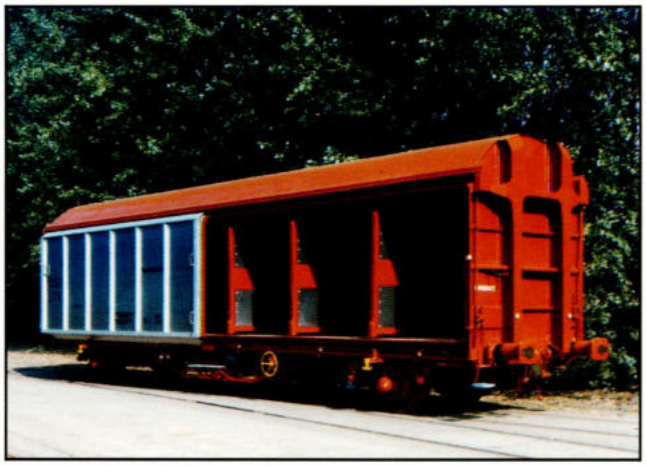
FORMERLY **LA BRUGEOISE ET NIVELLES**



1	2
3	4
5	6

1 – Self-discharging wagon with lateral sliding roof type Tadgs for Deutsche Reichsbahn - GDR
2 – Freight wagon with sliding sides type Hbikks for S.N.C.B. (Belgian Railways)
3 – Hopper wagon type Fals for C.F.L. (Luxemburger Railways)
4 – Coil wagon type Shimms for S.N.C.B. (Belgian Railways)
5 – Container wagon type Sgss for N.S. (Dutch Railways)
6 – Bogie drop sided flat wagon type Rmns for S.N.C.B. (Belgian Railways)

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