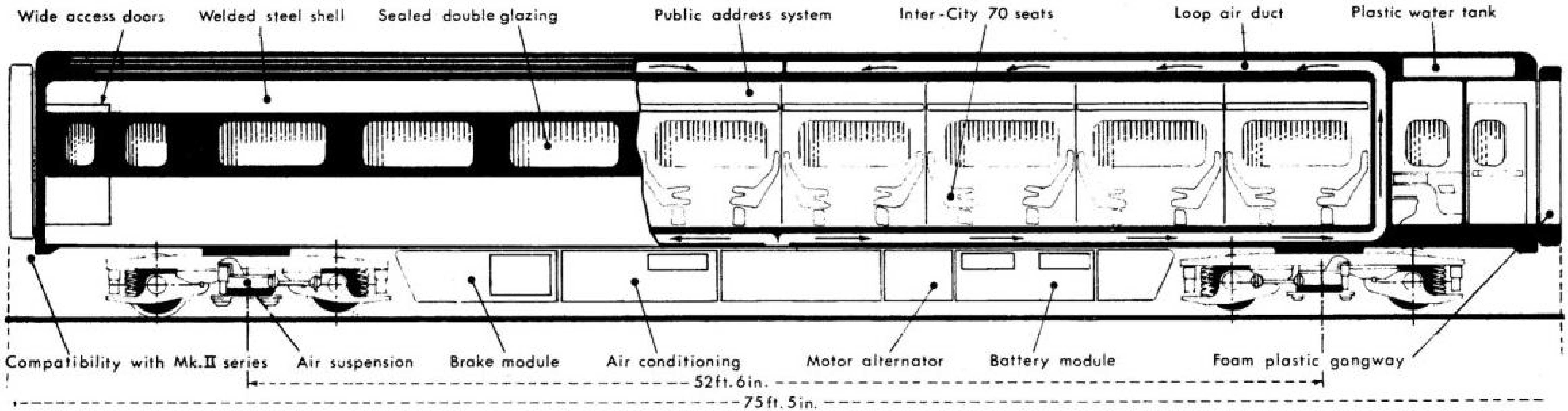
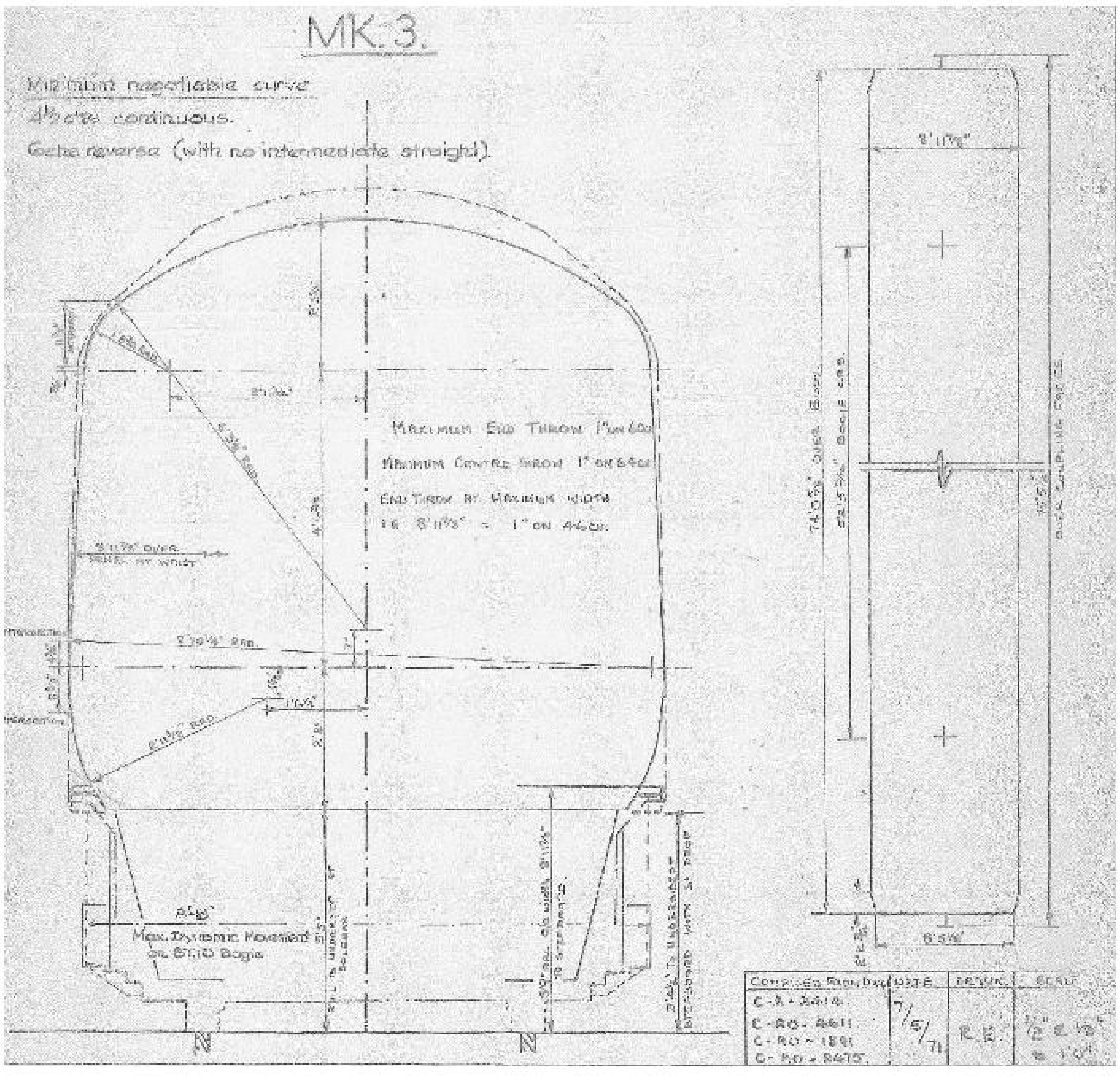
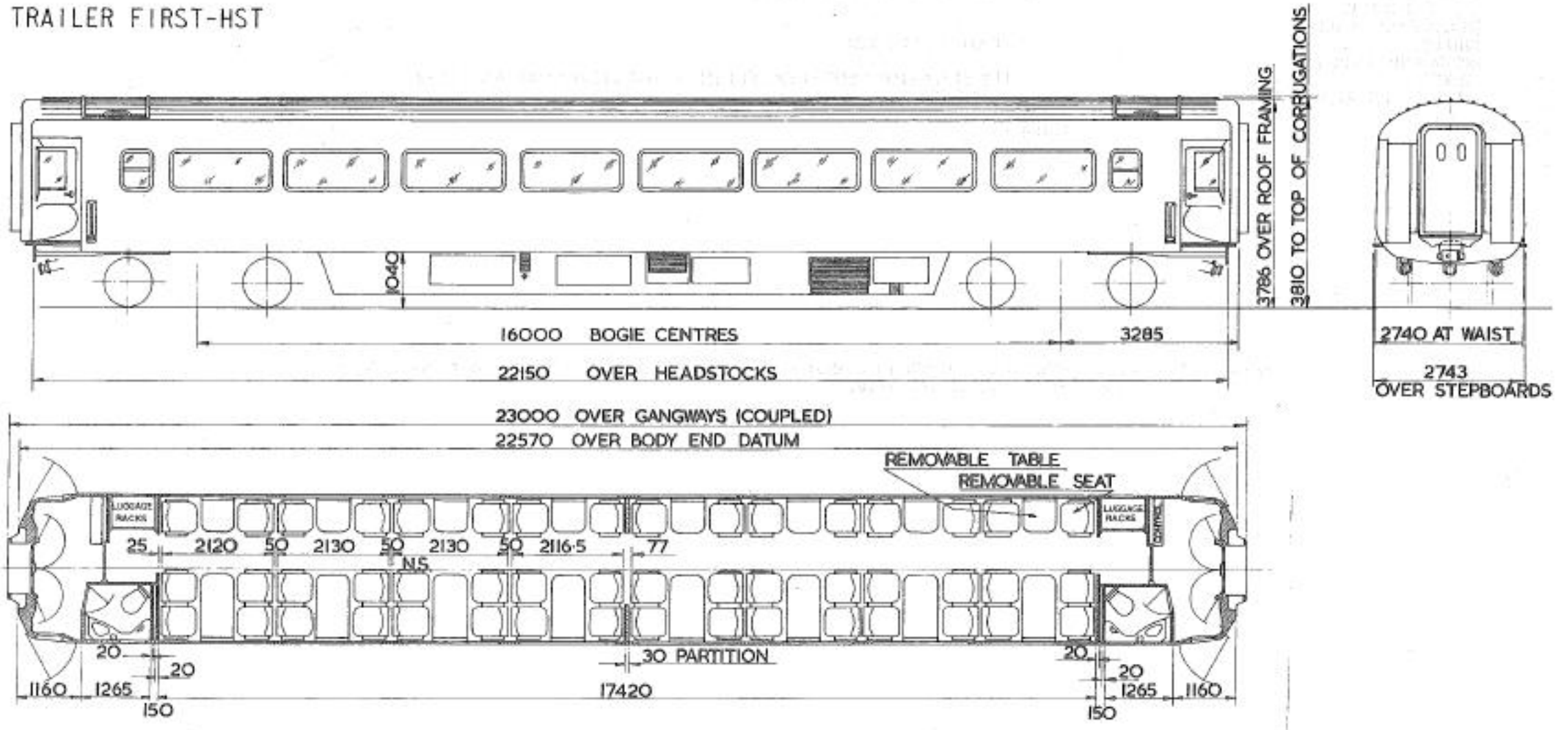

Wide access doors
Welded steel shell
Sealed double glazing
Public address system
Inter-City 70 seats
Loop air duct
Plastic water tank
Compatibility with Mk.II series
Air suspension
Brake module
Air conditioning
Motor alternator
Battery module
Foam plastic gangway
52 ft. 6 in.
75 ft. 5 in.


MK.3.
Minimum negotiable curve
continuous.
reverse (with no intermediate straight).
Maximum End Throw
Maximum Centre Throw
Max. Dynamic Movement

TRAILER FIRST-HST



SEATS	48
TOILETS	2
COMPARTMENTS	-
GUARDS COMPARTMENTS	-
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	-

	BASIC TYPE	ALTERNATIVES
BRAKES	AIR	
BOGIE/SUSPENSION	BT10	BT10b-CLASS 253
BODY CONSTRUCTION	STEEL	
COUPLINGS	AUTOMATIC SOLID SHANK(ALLIANCE NO 2 LONG SHANK)	
TRAIN HEATING	ELECTRIC(BR)FULL AIR CONDITIONDING	
MAX.SPEED M.P.H.	125	
MIN.RAD.CURVE CHAINS	4.5	4.1
LIGHTING	FLUORESCENT & TUNGSTEN	
TARE WEIGHT TONNES	33	33.5
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE	
TRAIN COMMUNICATION	PUBLIC ADDRESS	
BUFFERS	NOT FITTED	
SEATS	INTER-CITY 70	A.P.T.

TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED CLASS 253 WESTERN REGION 1976,WEST OF ENGLAND 1979,NORTHEAST/SOUTHWEST INTRODUCED 1981.
CLASS 254 EASTERN REGION 1978.

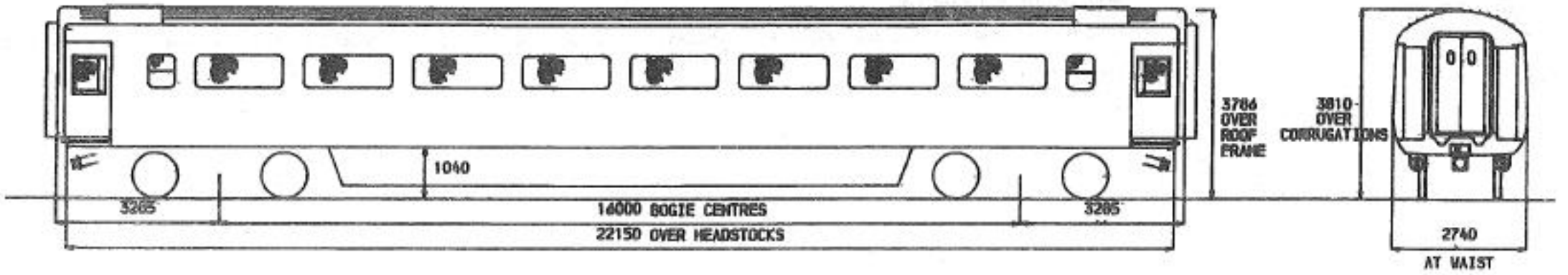
BASIC TYPE

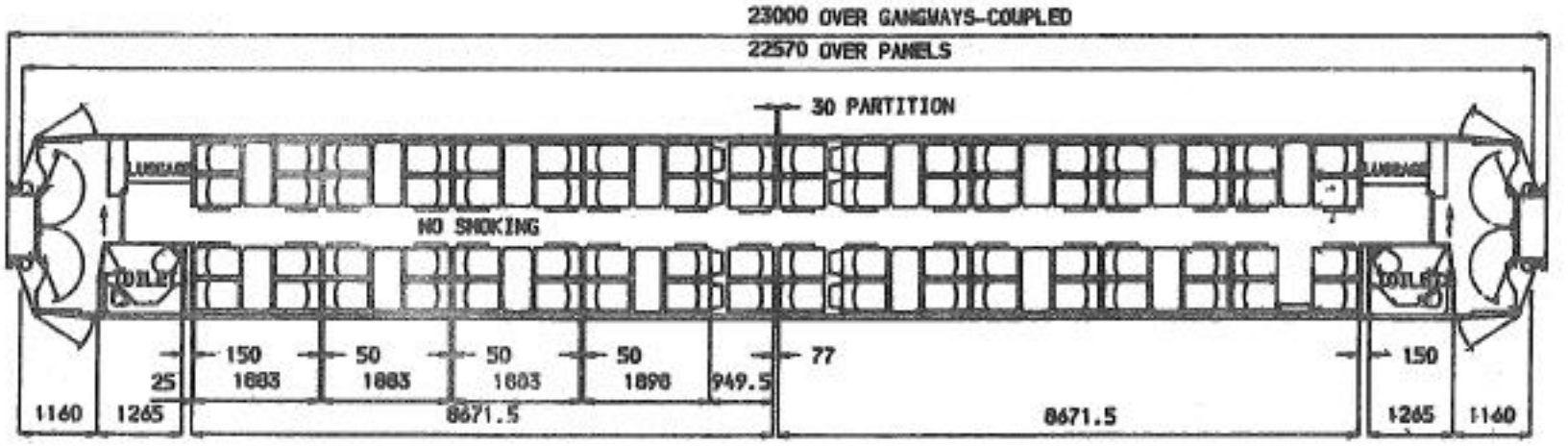
GH 102 0A

VARIANTS

0B BT10b-CLASS 253 BOGIES,TARE 33.5.
0D BT10b-CLASS 253 BOGIES,TARE 33.5,APT SEATS.
1C CONVERTED PROTOTYPE,4.1 MIN.RAD.CURVE

TRAILER SECOND-HST





SEATS	72	
TOILETS	2	
COMPARTMENTS	-	
GUARDS COMPARTMENTS	-	
VENTILATION	FULL AIR CONDITIONING	
CATERING EQUIPMENT	-	

		ALTERNATIVES
BRAKES	AIR	
BOGIE/SUSPENSION	BT10	BT10b-CLASS 253
BODY CONSTRUCTION	STEEL	
COUPLINGS	AUTOMATIC SOLID SHANK (ALLIANCE NO.2-LONG SHANK)	
TRAIN HEATING	ELECTRIC (BR) FULL AIR CONDITIONING	
MAX. SPEED M.P.H.	125	
MIN. RAD. CURVE CHAINS	4.5	
LIGHTING	FLUORESCENT & TUNGSTEN	
TARE WEIGHT TONNES	35	34, 33.5
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FOAM DIAPHRAGM-STEEL FACE PLATE	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS	
BUFFERS	NOT FITTED	

TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED-CLASS 253 W.R. 1976, W. OF ENGLAND 1979, NORTHEAST/SOUTHWEST TO BE INTRODUCED-CLASS 254 E.R. 1978.

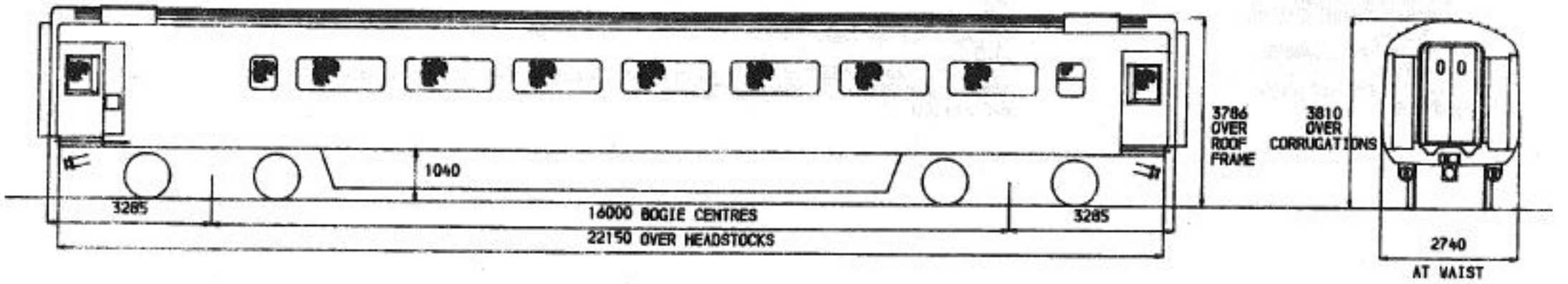
BASIC TYPE

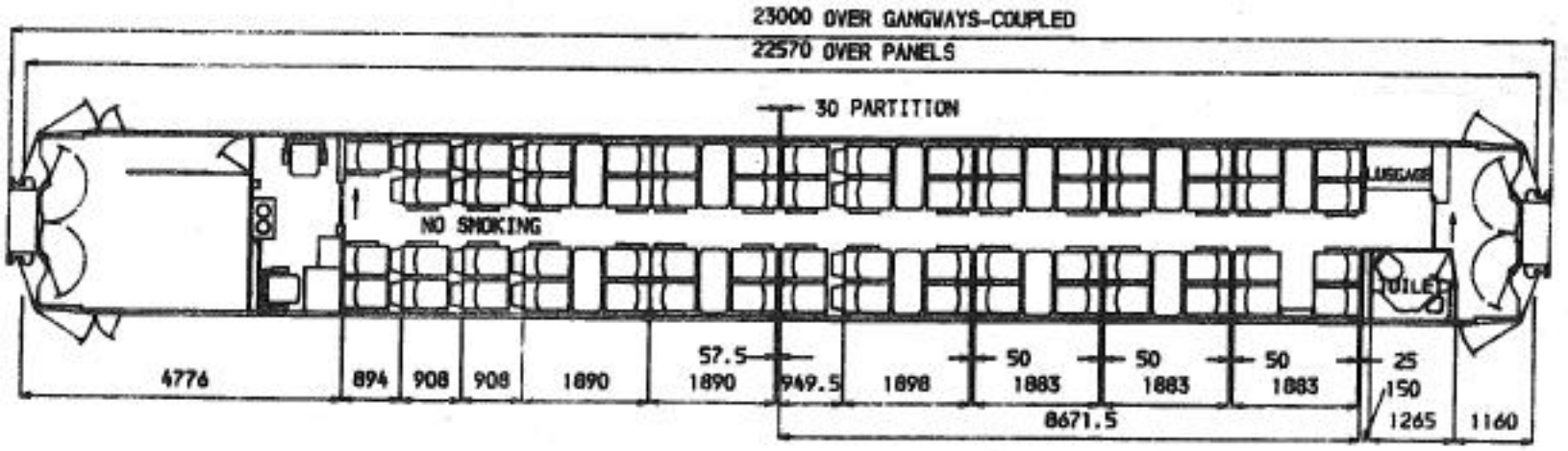
GH 202 0A

VARIANTS

0B TARE 34, GANGWAY HAS FLEXIBLE DIAPHRAGM.
0C TARE 33.5, GANGWAY HAS FLEXIBLE DIAPHRAGM, BT10b BOGIES.

TRAILER GUARDS SECOND-HST





SEATS	63
TOILETS	1
COMPARTMENTS	-
GUARDS COMPARTMENTS	1
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	-

BRAKES	AIR
BOGIE/SUSPENSION	BT10b
BODY CONSTRUCTION	STEEL
COUPLINGS	AUTOMATIC SOLID SHANK (ALLIANCE NO.2-LONG SHANK)
TRAIN HEATING	ELECTRIC (BR) FULL AIR CONDITIONING
MAX. SPEED M.P.H.	125
MIN. RAD. CURVE CHAINS	4.5
LIGHTING	FLUORESCENT & TUNGSTEN
TARE WEIGHT TONNES	33.5
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS WITH TRANSMITTER
BUFFERS	NOT FITTED

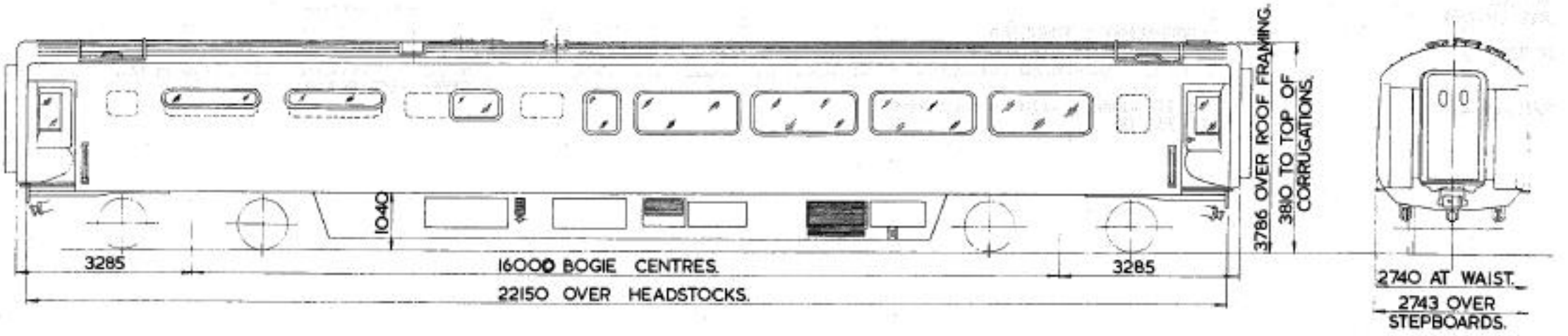
TRACTION DATA FOR MULTIPLE UNITS

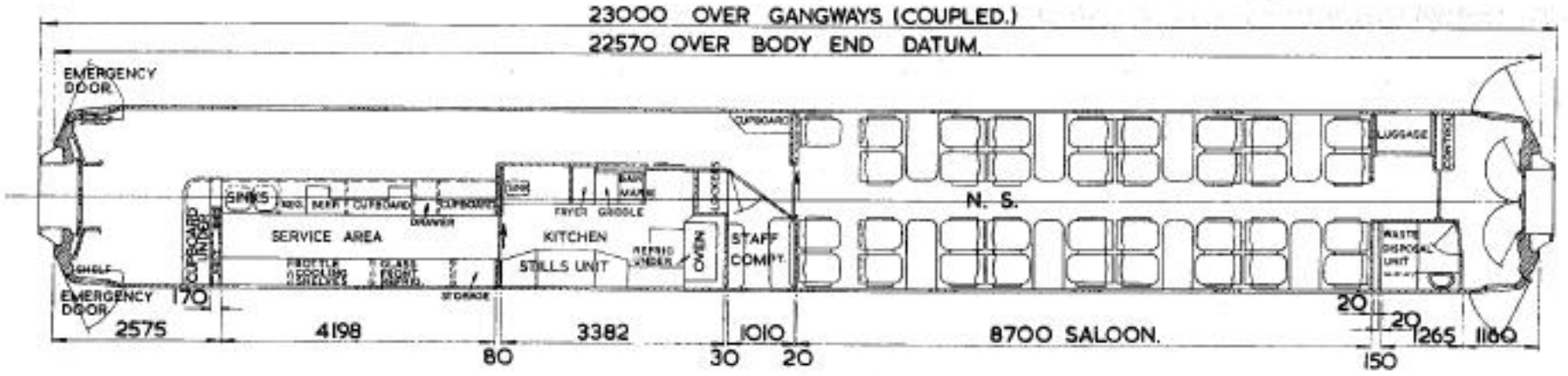
HST- TO BE INTRODUCED.

BASIC TYPE

GJ 201 0A

TRAILER RESTAURANT SECOND WITH BUFFET-HST





SEATS	35
TOILETS	-
COMPARTMENTS	-
GUARDS COMPARTMENTS	-
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	ELECTRIC MICROWAVE/MICROAIRE

		ALTERNATIVES
BRAKES	AIR	
BOGIE/SUSPENSION	BT10 & BT10a (ONE OF EACH)	
BODY CONSTRUCTION	STEEL	
COUPLINGS	AUTOMATIC SOLID SHANK (ALLIANCE NO 2 LONG SHANK)	
TRAIN HEATING	ELECTRIC (BR) FULL AIR CONDITIONING	
MAX. SPEED M.P.H.	125	
MIN. RAD. CURVE CHAINS	4.5	
LIGHTING	FLUORESCENT & TUNGSTEN	
TARE WEIGHT TONNES	36	
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FOAM DIAPHRAGM-STEEL FACE PLATE	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS WITH TRANSMITTER	
BUFFERS	NOT FITTED	

TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED-CLASS 253 WESTERN REGION 1976-CLASS 254 EASTERN REGION 1978.

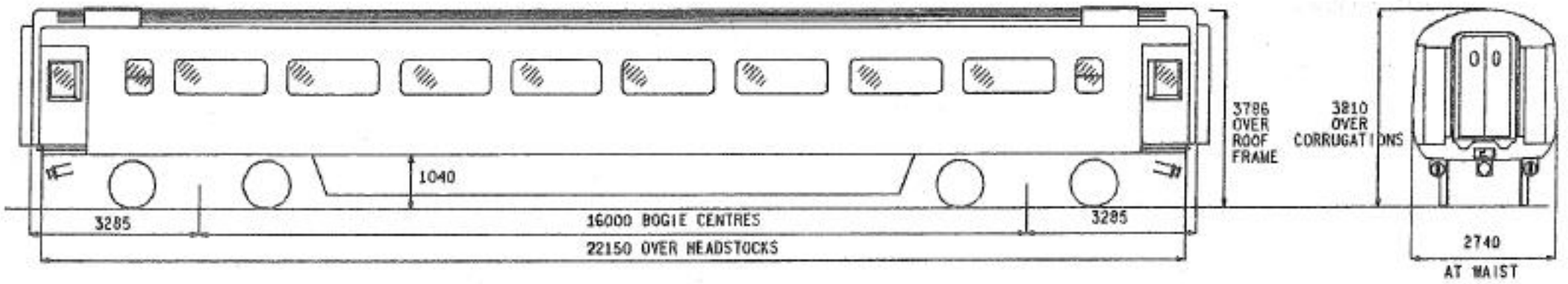
BASIC TYPE

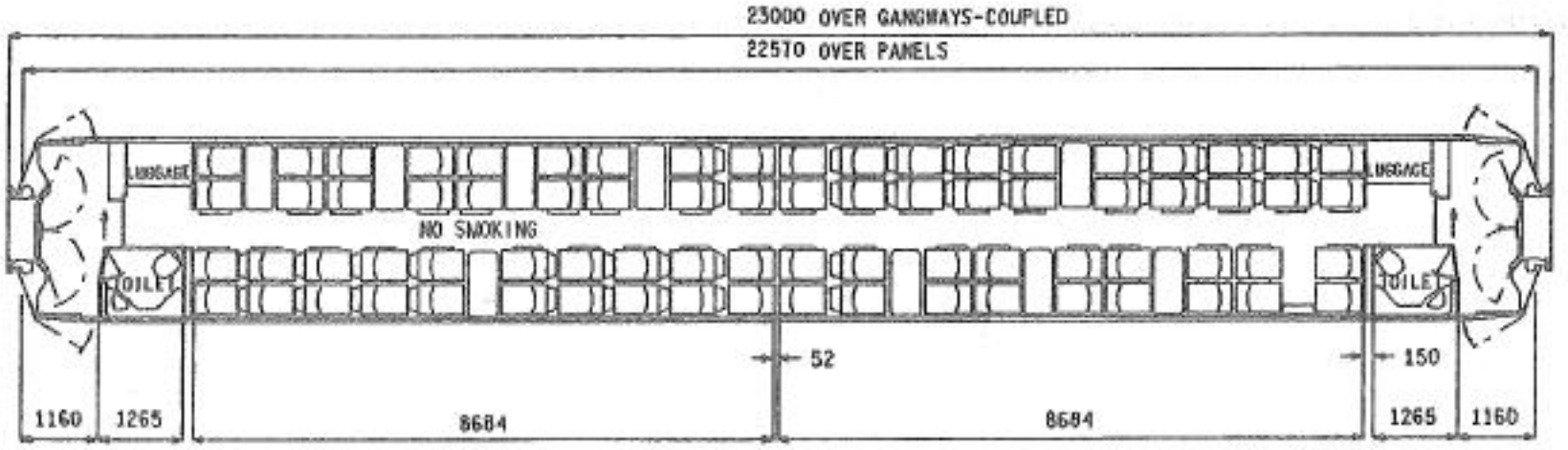
GK 202 0A

VARIANTS

0B GANGWAYS HAVE FLEXIBLE DIAPHRAGM.

TRAILER SECOND-HST





SEATS	76
TOILETS	2
COMPARTMENTS	-
GUARDS COMPARTMENTS	-
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	-

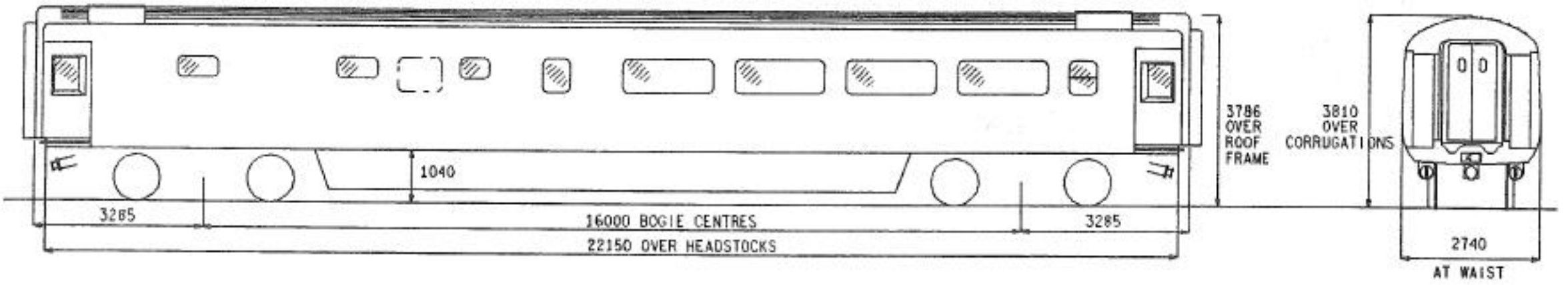
BRAKES	AIR
BOGIE/SUSPENSION	BT10b
BODY CONSTRUCTION	STEEL
COUPLINGS	AUTOMATIC SOLID SHANK(ALLIANCE NO.2-LONG SHANK)
TRAIN HEATING	ELECTRIC(BR)FULL AIR CONDITIONING
MAX.SPEED M.P.H.	125
MIN.RAD.CURVE CHAINS	4.5
LIGHTING	FLUORESCENT & TUNGSTEN
TARE WEIGHT TONNES	33.5
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHGRAM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS
BUFFERS	NOT FITTED
SEATS	INTER CITY 70

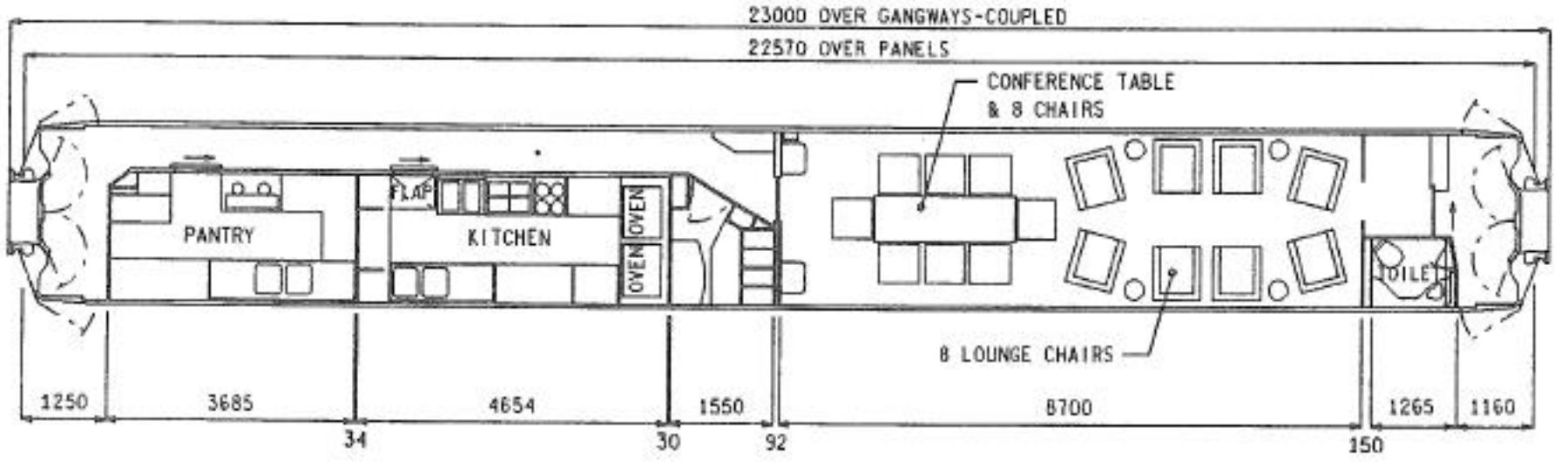
TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED-CLASS 253 W.R.1976,W.OF ENGLAND 1979,NORTHEAST/SOUTHWEST 1981.
MODIFIED FOR EXECUTIVE HST 1983.

BASIC TYPE	VARIANTS
GH 203 0A	0B A.P.T.SEATS

TRAILER LOUNGE UNCLASSED WITH KITCHEN-HST





SEATS	16
TOILETS	1
COMPARTMENTS	-
GUARDS COMPARTMENTS	-
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	ELECTRIC-MICROWAVE/MICROAIRE

	BASIC TYPE
BRAKES	AIR
BOGIE/SUSPENSION	BT10 & BT10a(ONE OF EACH)
BODY CONSTRUCTION	STEEL
COUPLINGS	AUTOMATIC SOLID SHANK(ALLIANCE NO.2-LONG SHANK)
TRAIN HEATING	ELECTRIC(BR)FULL AIR CONDITIONING
MAX.SPEED M.P.H.	125
MIN.RAD.CURVE CHAINS	4.5
LIGHTING	FLUORESCENT & TUNGSTEN
TARE WEIGHT TONNES	36.5 (ESTIMATED)
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS
BUFFERS	NOT FITTED

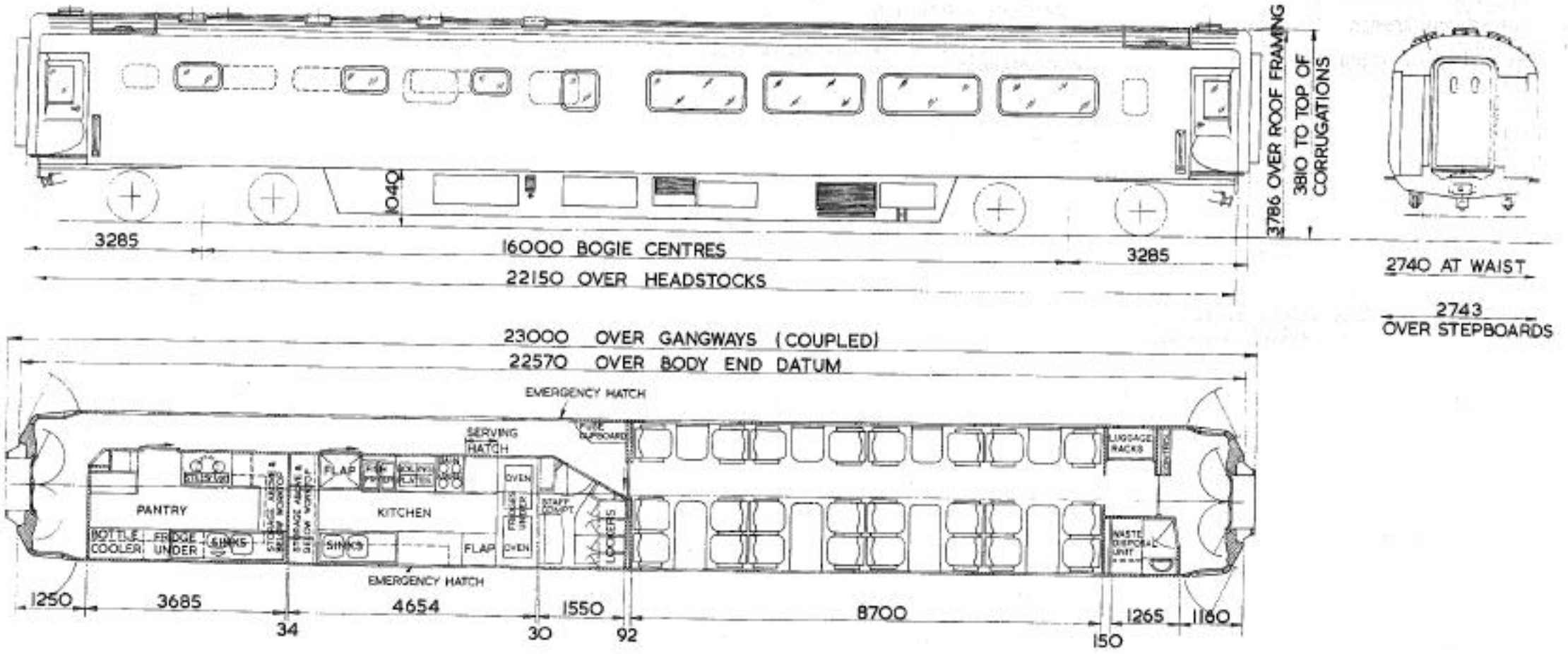
TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED 1978,-MODIFIED TO LOUNGE CAR 1984.

BASIC TYPE

GM 401 0A

TRAILER RESTAURANT UNCLASSED WITH KITCHEN-HST



SEATS	24
TOILETS	-
COMPARTMENTS	-
GUARDS COMPARTMENTS	-
VENTILATION	FULL AIR CONDITIONING
CATERING EQUIPMENT	ELECTRIC-MICROWAVE/MICROAIRE

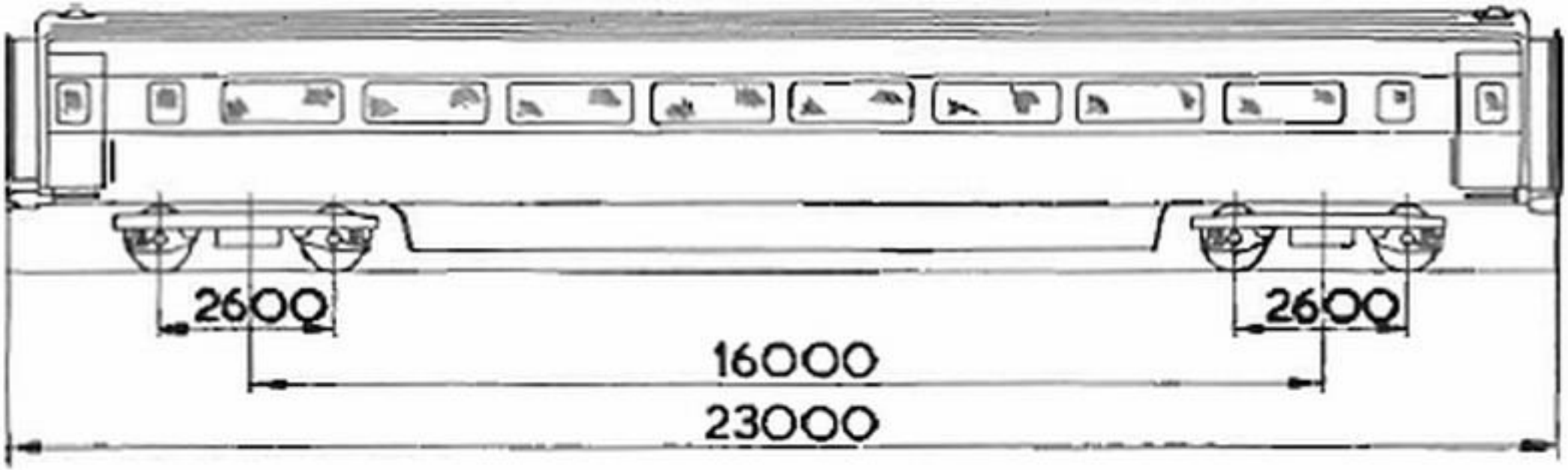
	BASIC TYPE
BRAKES	AIR
BOGIE/SUSPENSION	BT10 & BT10a (ONE OF EACH)
BODY CONSTRUCTION	STEEL
COUPLINGS	AUTOMATIC SOLID SHANK (ALLIANCE NO.2-LONG SHANK)
TRAIN HEATING	ELECTRIC (BR) FULL AIR CONDITIONING
MAX. SPEED M.P.H.	125
MIN. RAD. CURVE CHAINS	4.5
LIGHTING	FLUORESCENT & TUNGSTEN
TARE WEIGHT TONNES	37
GANGWAYS	CENTRALLY SUPPORTED-SWIVELLING-FLEXIBLE DIAPHRAGM-STEEL FACE PLATE
TRAIN COMMUNICATION	PUBLIC ADDRESS
BUFFERS	NOT FITTED

TRACTION DATA FOR MULTIPLE UNITS

HST- INTRODUCED 1976.

BASIC TYPE

GL 402 0A



MARK III CARRIAGE

Welded Steel Shell

Air Sprung Disc Braked Bogies

Air Conditioned

Automatic Interior Doors

Chemical Toilets

Weight 33 – 39 Tonne

First Class	48 Seats
Second Class	72 Seats
Kitchen	23 Seats
Buffet	34 Seats

TRAILER CARS - THE MARK III COACH

DEVELOPMENT OF BR COACHES 1948-1972

When BR was formed in 1948, it inherited a varied collection of passenger coaches from the four Railway Companies. In 1951 the first examples of the BR Mark I range of coaches entered service; they were of conventional design with a load-carrying underframe supporting an all-steel welded body. The Mark I was equipped with vacuum brake, steam heating, and the conventional steel section frame bogies were designed for speeds up to 145 km/h.

The Mark II coach was introduced in 1963. It was 20 metres long, integrally constructed of steel, with a pressurised ventilating and heating system, and bogies designed to run at 160 km/h.

High platforms in passenger stations (many of them on sharp curves) together with the limiting dimensions of fixed structures on the track, restrict the length and width of British Railway passenger coaches compared with their continental equivalents. However improved design techniques and some civil engineering work has now made it possible to obtain acceptable route availability for a coach 23 metres long.

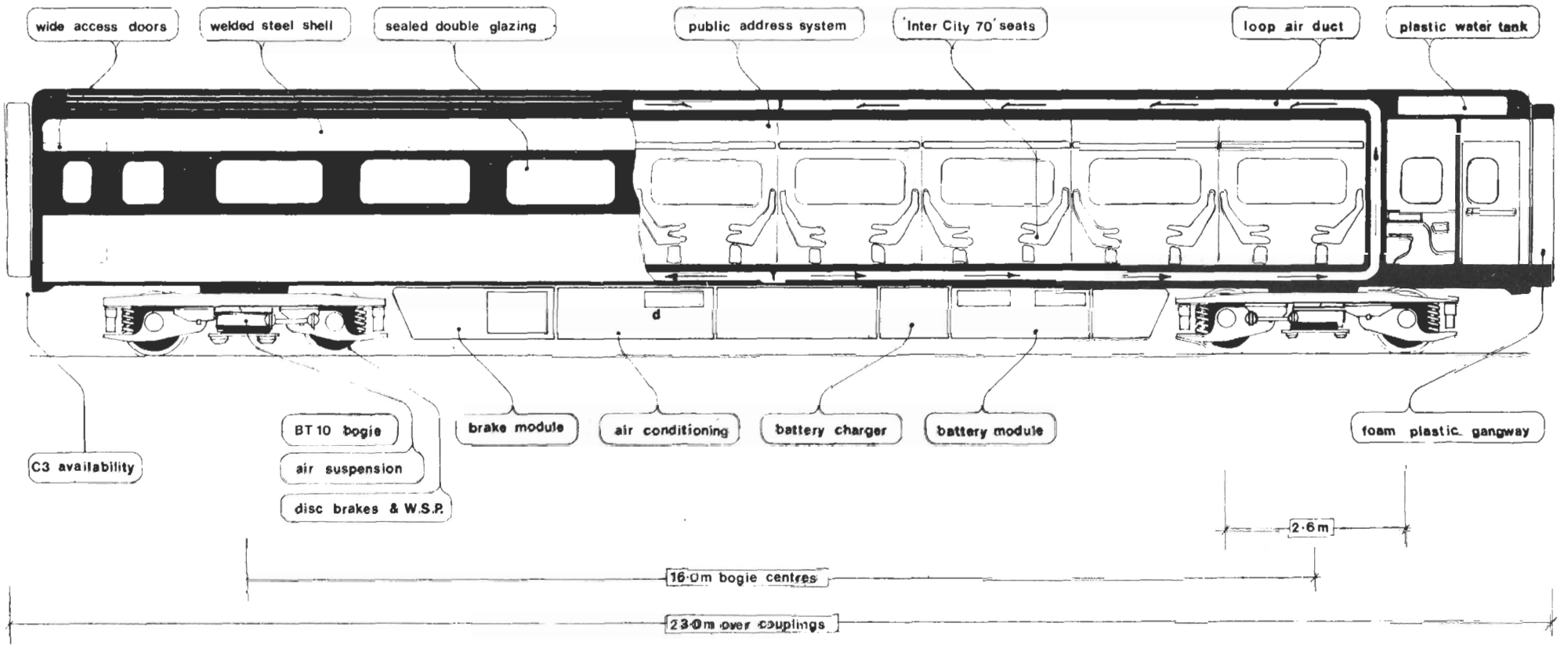
THE MARK III COACH

The Mark III coach has benefitted from improved technology and materials which have become available since the Mark II coach was introduced. The modular body shell construction can be used for either first or second class seat layout and can be converted internally if required to meet changing business requirements. The same basic structure principles are maintained in catering vehicles.

The coaches are designed to operate at 200 km/h with high annual mileage and minimum maintenance.

BODY STRUCTURE

The stressed skin structure is of integral all welded, mild steel construction and was designed with the aid of computer based finite element analysis techniques to give strength and stiffness, with light weight and minimum first cost.



Mk3 day coach

As the HST will run as a fixed consist, side buffers are not required and all vehicles are fitted with solid shank buckeye couplers, with lateral side control.

The gangways between vehicles are attached to the couplers in such a way that a pair of mating gangways is always in line, even when the HST is negotiating a tight curve.

INTERIOR TRIM AND SEATING

The coach has wide entrance doors at its ends leading into a vestibule, from which is access to the toilet compartment. The sliding doors separating the vestibule (and toilet compartment) from the passenger saloon, are automatically operated by treadmats positioned in the approach floor areas.

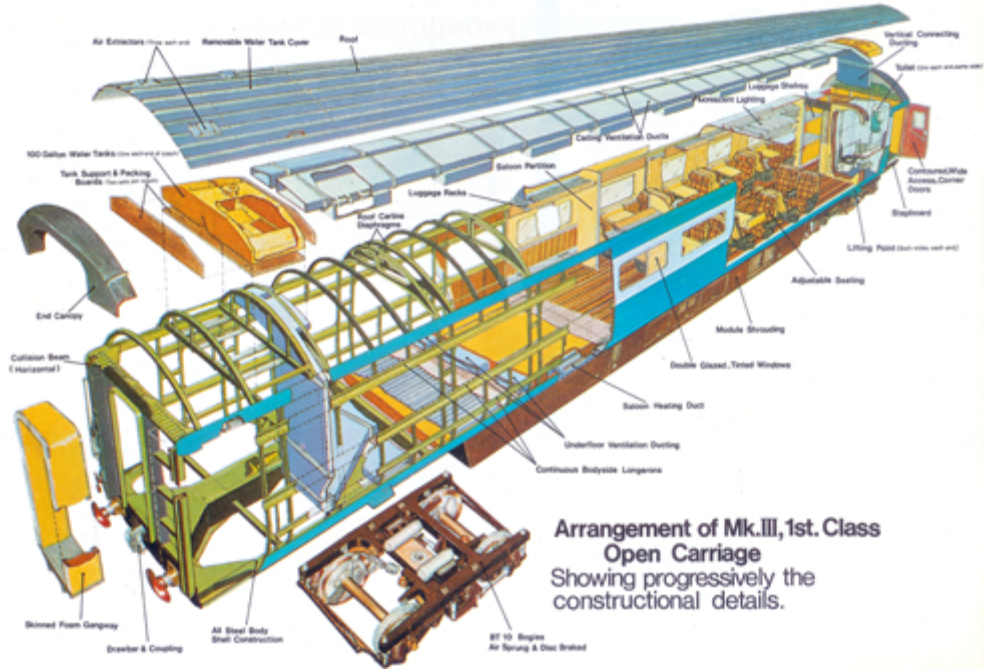
Seat and table fixing rails are fitted the full length of the floor and bodyside so that 1st and 2nd class ergonomically designed seats can be fitted as required at appropriate spacing. 1st Class seating is positioned in the basic layout to give 48 seats and 2nd class to give 72 seats. Seat covers are removable for cleaning.

In 1st Class coaches the seats are individually adjustable. One end seat and table have been designed to be readily removable in order to provide room for a disabled passenger in a wheelchair. (of $23\frac{1}{2}$"/600 mm max. width) The removed seat is stored in the luggage compartment and the table in the end luggage bay.

INTERIOR FEATURES

The vestibule is furnished with coloured glass reinforced polyester panels and mouldings for brightness, cleanliness and ease of maintenance. The toilet compartment is pre-constructed in three sections which are assembled in position as a module. The plastic water-tank can be removed through a hatch on the outside of the roof.

Double glazed sealed windows with tinted float glass are fitted and moulded glass reinforced polyester interior surrounds give easy access to the windows for replacement purposes.



Arrangement of Mk.III, 1st. Class Open Carriage

Showing progressively the constructional details.

Hand luggage storage is provided on a continuous overhead rack and additional storage for large cases etc is between seats or in the luggage bay at the vehicle end.

Lighting is fluorescent from ceiling mounted diffusers. Each 1st class seat position has a reading light.

The coach is fully air conditioned, the system being able to maintain an interior temperature of 21°C in ambient temperatures in the range -6°C to 28°C.

ELECTRIC SUPPLY

The coach is supplied with 415 V 3-phase a.c. from the power car permitting advantage to be taken of commercially available electric equipment and technical advances.

The air conditioning system operates at 415 V. The supply is also converted to 110 V d.c. for lighting, control and battery charging.

Each coach has multi-core cables for the through train control.

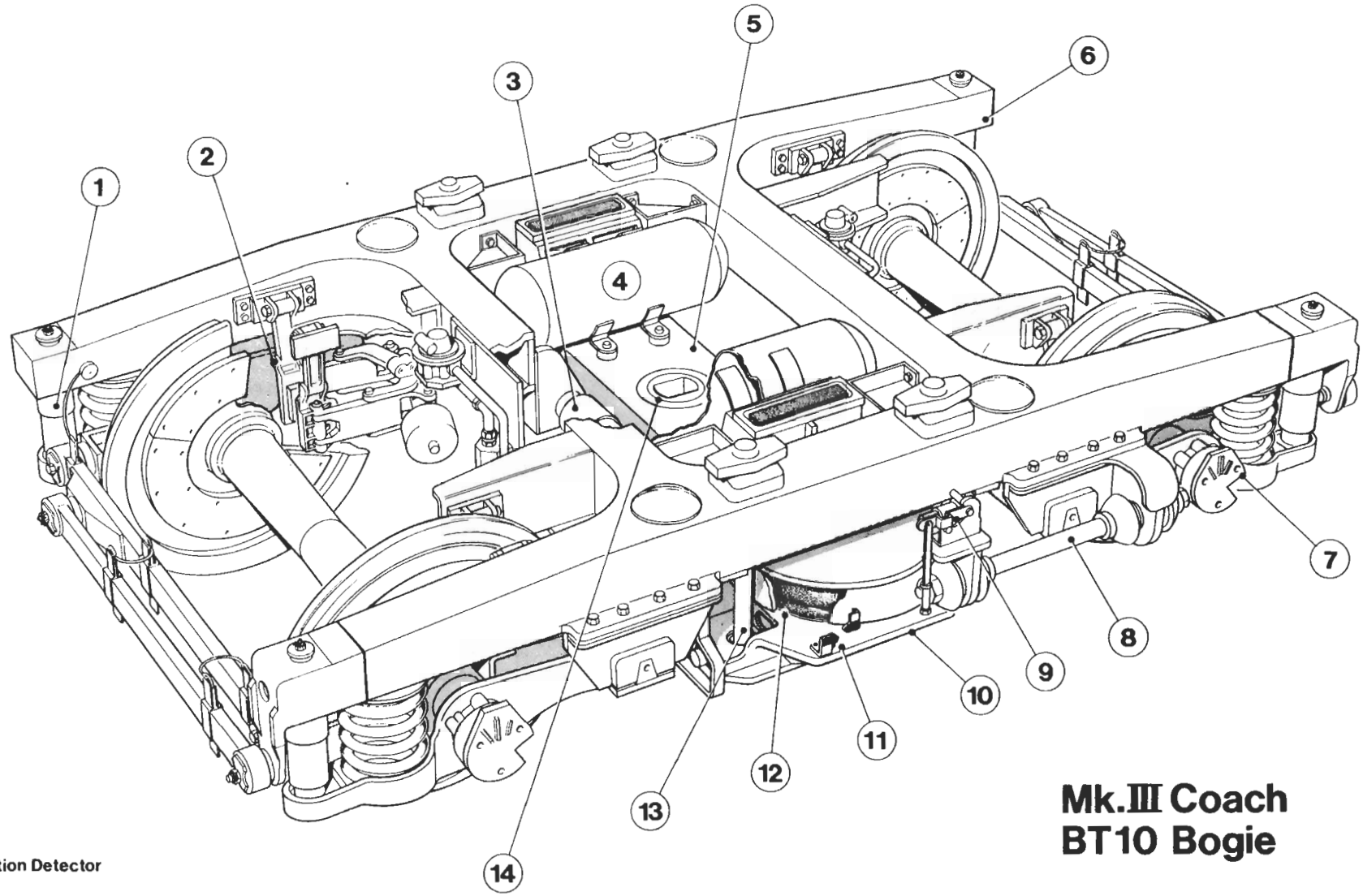
These HST vehicles are not electrically compatible with locomotive hauled Mk III coaches which operate at 850 V nominal d.c. or a.c. In any case this particular feature will not present operating problems as each HST is regarded as a semi-permanent unit.

MODULAR EQUIPMENT LAYOUT

Power and control equipment is located underneath the body structure and contained within the skirting between the bogies, which gives protection from damage and maintains cleanliness. Access to the equipment is by hinged doors along the sides and removable panels from the underside.

In addition complete modules of equipment assemblies can be removed for maintenance elsewhere and replaced by modules drawn from depot stores. Air and electric connections to the modules are of quick make-and-break types. The four principal modules are:-

(1) Brake and air suspension
(2) Air conditioning
(3) Battery
(4) Battery Charger



1 Primary Damper
2 Disc Brake
3 Lateral Damper
4 Air Reservoir
5 Bolster
6 Bogie Frame
7 Wheel Slide Protection Detector
8 Traction Rod
9 Levelling Valve
10 Spring Plank
11 Air Suspension Indicator
12 Air Spring
13 Swing Link
14 Centre Pivot

Mk.III Coach
BT10 Bogie

The brake and air conditioning modules are designed such that they can be obtained as fully interchangeable package units from alternative suppliers.

BOGIE

The bogie is designed to give safe, comfortable riding up to 200 km/h, and has been extensively tested in service.

The frame is of all-welded, mild steel construction, designed to run at low maintenance cost.

The primary suspension is by trailing arm with a rubber bushed pivot and one coil spring per wheel. Lateral control of the wheelsets is by rubber bushed links between the trailing arms and the bogie frame. The monobloc wheels carry cast iron cheek plates for the Girling disc brakes.

The secondary vertical suspension is by air springs with levelling valves to maintain constant body height. In the lateral plane long pendulum links are used, with a torsion bar to control body roll.

Hydraulic dampers are fitted to the primary vertical and secondary lateral suspension, whilst air damping is employed on the secondary vertical suspension.

The weight of the body is carried on the bogie bolster by 2 side bearers of low-friction material which control bogie rotation.

The bogie pivots on a pin which has rubber bushed guides which transmit traction and braking forces to the bolster. Rubber bushed traction links transmit forces between the bolster and bogie frame.

angel Trains

Manufacturer / Model	BR Derby - Mark3
Year of Build	1976-84
Length	23.0 m
Width	2.82 m
Weight	33.66t (TF), 33.60t (TS), 33.47t (TGS), 36.12t (TFB/TSB), 38.16t (TFKB)
Bogies	BT10B
Maximum Speed	125 mph
Couplers	Alliance or Blair BSC
Brakes	Disc
Seating	2+2 (1+2 in 1st class) TF-48 1st class seats per vehicle; TS-65, 72 or 76 Std seats per vehicle, TGS-65-63 Std seats per vehicle
Gangways	Flexible diaphragm
Doors	Slam at vehicle ends. Secondary door locking
Other Features	Public Address, Air Conditioned, PIS(XCT only), Wi-Fi (ECML only)
Formation	Operate as part of 6, 8 or 9-car rakes in conjunction with an HST power car at each end. Toilets at each TF and TS coach and one end of the TGS vehicle.

Technical Information

Specification

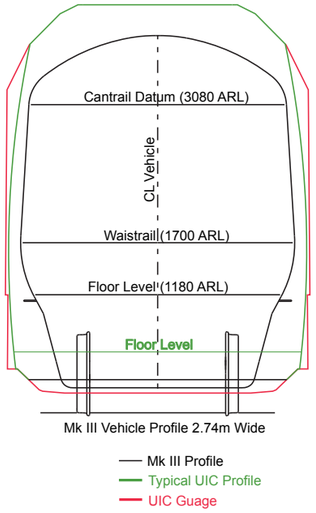
Build Date	1975-1986
Track Gauge	1435mm
Traffic Type	Designed for Inter-City use
Traction current/supply	700-1000v ac or dc feed
Length over headstocks	22150mm
Width at waist	2740mm
Roof height over frame	3810mm
Floor height above rail	1180mm
Bodyshell material	Integral monocoque welded steel construction
Tare weight	34.3-39.8 tonnes
Number of doors	4 per vehicle
Door type	Outward opening slam type
Bogie centres	16000mm
Bogie wheelbase	2600mm
Wheel diameter	914mm new; 836mm scrap
Bogie type	BT10
Primary suspension	Vertical: Radial arm with single helical spring and viscous damper. Lateral: Lateral control rod
Secondary suspension	Air spring with height- and load-controlled adjustment
Maximum design speed	200km/h (125mph)
Maximum UK operational speed	175km/h (110mph)
HVAC system	Modular underframe mounted
Braking system	Wheel mounted disc brakes, 2 pipe UIC control
Coupler type	Buckeye coupler or standard BR drawhook
Height of the coupler centreline above rail	991mm-1003mm
Distance between buffer centres	1725mm
Height of buffer centreline above rail	1046 - 1066mm
First Class Seats (2+1 formation)	48 seats (FO)
	37 seats (FOB)
	22 seats / 18 seats (RFM)
Standard Class Seats (2+2 formation)	76 seats / 80 seats (TSO)
	70 seats (TSO with wheelchair space)
	52 seats (TSOB)
Number of toilets	2 per vehicle (1 per vehicle; RFM, FOD & TSOB)

Route Availability

The Mk3 coach has gauge clearance to operate over most routes in the UK. It should be noted that the structure gauge in the UK is somewhat smaller than the UIC gauge used in most European countries, so wide route availability should be expected for the Mk3 coach where UIC gauge applies.

The vehicles are 23000mm long over the coupling planes and 22570mm long over the body. Bogie pivot center spacing is 16000mm. Maximum body width is 2740mm across the waist. The body ends are tapered in plan view to reduce the overthrow on small radius curves. Overall height is 3810mm to top of roof, or 3906mm to top of roof equipment.

The Mk3 vehicles are fitted with one of two types of bogie, both designated as the “BT10” bogie. The difference between the two types is the length of the swing-links in the secondary lateral suspension. The ride performance of each type is indistinguishable by the passenger. The benefit of the short swing-link version is that it gives clearance to lines where there is electrification by a third rail outside of the running rail.



Permanent Way

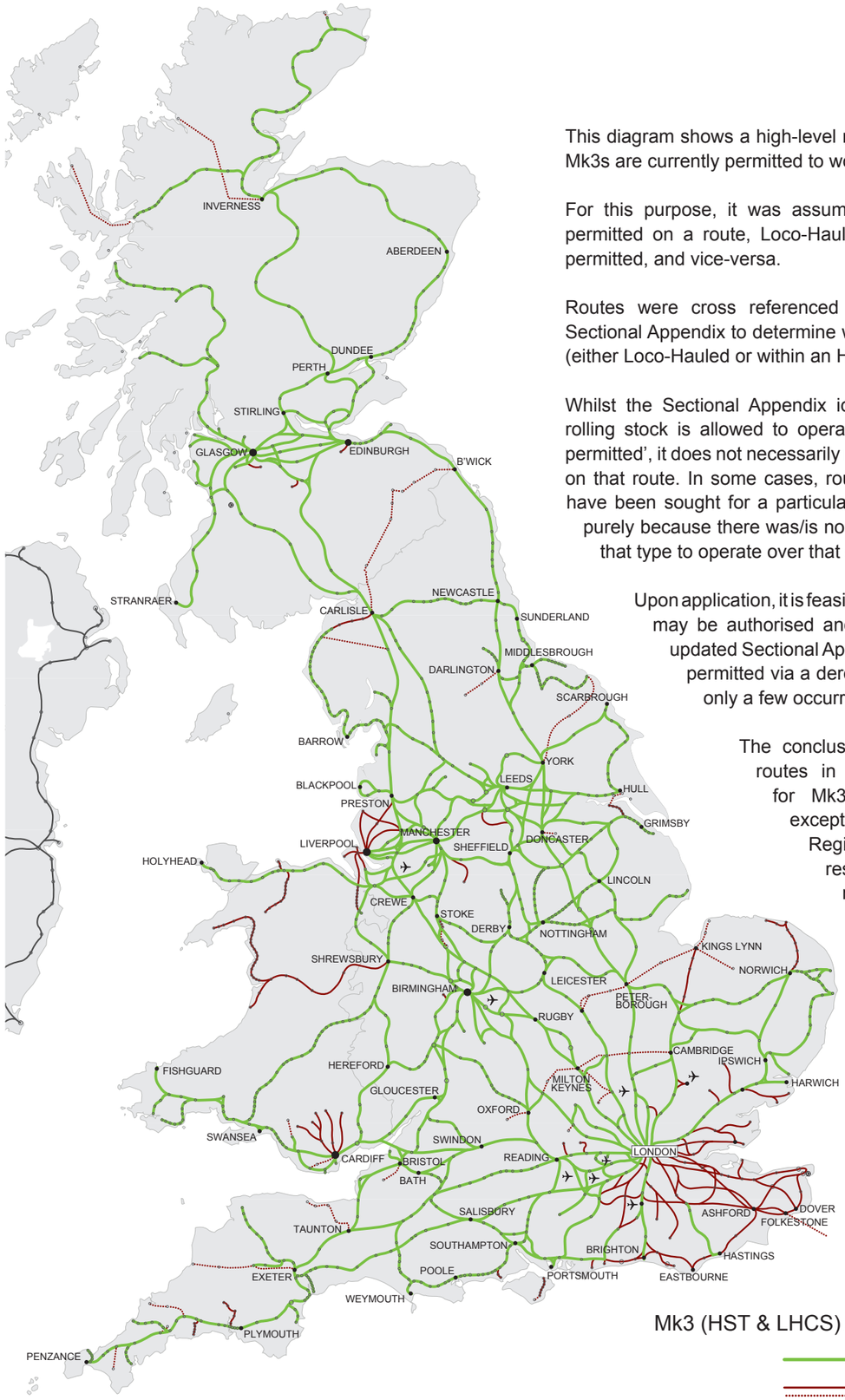
The vehicles have operated successfully in the UK for many years on 1432 - 1435mm gauge track with 1:20 inclined rails at speeds of up to 175km/h (110mph). The suspension gives a high level of ride comfort for passengers at high speed on good quality track and at lower speeds on poorer quality track. On other (virtually identical) vehicles, similar bogies are regularly used at 200km/h (125mph).

The Mk3 coaches in the UK use a “P8” wheel profile. This gives a conicity of about 0.2 when new in combination with a 1:20 inclined rail, and a conicity range of about 0.05 - 0.40 taking account of normal wheel and rail profile wear and gauge variation. The vehicle is stable up to 200km/h under such conditions (it is believed that a similar conicity range of 0.20 new and 0.05 - 0.40 worn is achieved with a UIC profile on 1:40 inclined rails).

The Mk3 coach has a soft primary roll suspension to ensure safety against derailment over track twists with the secondary vertical air suspension in inflated and in deflated condition. The vehicles are safe to operate to full speed with air suspension in deflated condition, but they are restricted to 160km/h (100mph) in the UK in such a condition in order to preserve passenger comfort.

Minimum curve radius is 90m, and the vehicles are designed to negotiate a minimum reverse curve radius of 120m.

The Mk3 coach was designed to operate to 110mm of track superelevation and 0.07g of uncompensated lateral acceleration. However, it has been operated in the UK to 150mm of superelevation and 0.10g of uncompensated lateral acceleration where the curve is well aligned.



This diagram shows a high-level review of routes where Mk3s are currently permitted to work.

For this purpose, it was assumed that if an HST is permitted on a route, Loco-Hauled carriages are also permitted, and vice-versa.

Routes were cross referenced to the Network Rail Sectional Appendix to determine whether Mk3 operation (either Loco-Hauled or within an HST set) is permitted.

Whilst the Sectional Appendix identifies routes where rolling stock is allowed to operate, if it shows as ‘not permitted’, it does not necessarily mean it cannot operate on that route. In some cases, route clearance may not have been sought for a particular type of rolling stock, purely because there was/is no logical explanation for that type to operate over that section of line.

Upon application, it is feasible that route clearance may be authorised and then reflected in an updated Sectional Appendix or, alternatively, permitted via a derogation if, for instance, only a few occurrences were planned.

The conclusion is that almost all routes in the UK are suitable for Mk3 operation with the exception of the Southern Region where usage is restricted to specific main routes and then only by HST’s adapted with short swing coupling bogies.

Wheels and Axles

The wheelsets have 914mm diameter monobloc wheels with wheel web mounted disc brakes and 120mm cartridge taper roller bearings which can be sourced from more than one supplier. Oil injection ways are provided to facilitate removal of the wheels from the axle. Each wheelset is fitted with Wheel Slide Protection (WSP).

Tread Profile and Wear Limits

Flange thickness after machining	29mm
Flange thickness fully worn minimum	24mm
Flange height after machining	30mm
Flange height fully worn maximum	36.5mm
Throat thickness maximum	30mm
Maximum permissible variation in wheel diameters between wheels on any one vehicle	25mm
Wheel dimension when new	914mm
Last turning dimensions	842mm
Scrapping dimensions	836mm

Braking System

The Mk3 coach has full duty disc brakes with a UIC compatible, 2-pipe auto air brake control system. The brakes are fully load compensated and will give a consistent performance from tare to crush load (seats full plus standees). There is a WSP system to minimise wheel damage in low adhesion conditions. There is no parking brake fitted to the vehicles.

The bogies are fitted with wheel mounted disc brakes to all wheels. These are cast-iron and are manufactured by SAB-WABCO. The brake pads are Becorit 922-1U. This material was developed to give long disc life with good friction characteristics.

The actuators are SAB-WABCO CAU2-190 incorporating slack adjusters to maintain a 1-2mm pad-to-disc clearance as the pad wears. The calliper assembly is suspended by rubber bushes from a central yoke on the bogie frame. The bushes within the calliper assembly are pressed in and are replaceable.

The control system is a UIC compatible 2-pipe auto air system. Brakes are Released at a 5 bar Brake Pipe pressure and Fully Applied at 3.5 bar. Davies & Metcalfe (now part of the SAB-WABCO group) manufacture the distributors.

Emergency handles are located in the saloon to provide passengers with a means of stopping the vehicle in an emergency.

The distributor output is fed to a relay valve (via a dummy cylinder) which has a feed from an averaging valve from two of the air suspension units. By this means, the output to the brake cylinders is varied in proportion to the load in the saloon.

The brakes can stop a train of Mk3 coaches (9 coaches + loco + DVT) from 175km/h in less than 1425m and from 160km/h in less than 1200m.

Mk3 vehicles are fitted with one of two Wheel Slide Protection (WSP) systems; a Girling system or a British Rail system. A superior system is now available from Knorr Bremse which is more reliable and will reduce maintenance costs. This system is already fitted on many High Speed Train vehicles and is recommended for the Loco-Hauled vehicles.

Electrical Systems

There are several Mk3 variants, each of which has similar basic electrical systems, although the details are different. The description below is therefore a generalisation with further details required as applicable for specific vehicle types. These vehicles are all compatible with other Mk3 Locomotive-Hauled types.

Power systems
Mk3 coaches are powered from the locomotive Electric Train Supply (ETS) at approximately 700V-1000V ac or dc, depending on the locomotive used. This is supplied to a motor alternator, supplied by Brush Electrical Ltd, which converts the ETS voltage into a 3 phase supply at a nominal 415Vac 50Hz. This is used to supply the Air Conditioning module and as 240Vac single phase for auxiliary equipment.

The motor alternator set also produces a rectified 110Vdc supply which is used for battery charging and control voltages. This 110Vdc supply is further reduced to 28Vdc for the Publie Address (PA) system supply.

On most Mk3s the motor alternator is rated at 22kVA at 1500rpm and is controlled by a voltage and frequency regulator, which maintains operation within design parameters.

The ETS is turned on or off by switching the ETS safety loop which runs along the train and back to the locomotive. This interrupts the ETS when there are exposed High Voltage ETS connectors. The ETS is equipped with earth fault indicators to display earth faults on either line. The full ETS voltage is also supplied to the Air Conditioning unit to power the heating elements.

Cross feed and load shedding
There is no cross feeding of power between vehicles apart from the central door locking system. Load shedding is limited to the removal of lighting loads when the battery voltage falls below approximately 80Vdc.

Auxiliary power supplies
The uses to which the various supplies are put is as described below.

415Vac
The motor-alternator set supplies 415Vac 3 phase to the air-conditioning unit.

240Vdc
Single phases are utilised as 240Vac 50Hz supplies to the following equipment:
- Toilet water heaters
- Electric shaver sockets
- Cleaner sockets
- Refrigeration controls (air conditioning unit)
- Toilet ventilation fans

110Vdc
This is rectified from the output of the motor-alternator set and supplies the following:
- Air conditioning control and fan motor
- Battery charging
- Lighting
- Door control equipment
- WSP equipment

28Vdc
This is derived from the 110Vdc supply and is used for the PA system.

240Vac
Mk3a RFM catering vehicles have a second ETS powered motor alternator, which supplies single phase 240Vac to much of the catering equipment, which is described in the subsequent section. These vehicles also have several ventilation fans and a convection oven supplied by the 3-phase system.

All vehicles are fitted with Emergency Egress Devices to allow passengers to unlock doors under emergency conditions. Operation of an Emergency Egress Device will apply the train brakes. All vehicles are also fitted with rotary Emergency Access Handles to unlock doors from outside the vehicle under emergency conditions. The Central Door Locking system is controlled using a dedicated set of train wires and jumpers.

Gangways
The gangway arrangement is the same at each end of each vehicle, making it possible to couple the vehicles in any orientation.

The gangways have solid faceplates that are supported from the drawbar on a spherical bearing which allows the faceplates to pitch and yaw relative to the vehicles. The attachment between the drawbar and faceplate is made through a stack of rubber shear units, which provide the force to keep the adjacent faceplates together. At the top of the faceplates this is achieved by a flexitor unit. One side of each faceplate is fitted with a non-metallic rubbing plate, so that metal to metal contact is avoided.

An outer rubber diaphragm is attached to both the vehicle end and the faceplate to provide weatherproofing. On the interior, flexible panelling is wound around a vertical roller, which is preloaded by a rubber torsion spring. The outer end of the flexible panel is attached to a hinged panel secured to the faceplate. This arrangement allows the faceplate to move longitudinally or rotate around the vertical axis, whilst the roller winds and unwinds to keep the flexible panelling taught and present a smooth interior surface. Height of gangway treadplates above rail = 1289mm - 1308mm.

Hubner diaphragms are recommended for gangway connections as they have a much longer life than the original design and can be relied upon to run between overhauls without leaking. They also provide a better passenger environment in the vehicle vestibules.

Windows
Each passenger vehicle has eight saloon windows and two smaller (toilet) windows on each side. The saloon windows are 1760mm x 660mm and the smaller windows 536mm x 660mm. The bottom edge of each window is at a height of 2188mm above the rail.

Currently vehicles are fitted with both laminated and toughened glass, however it is recommended that laminated glass is fitted in-line with the latest safety recommendations.

Catering Facilities

Catering Facilities
The catering vehicle is typically equipped to enable preparation and service of a range of meals, both hot and cold, in addition to a buffet service facility.

Main Areas
- Trolley stowage and product assembly area
- First & Second Class trolleys
- Kitchen area
- Preparation sinks, hand washbasin, hot water boiler, grill, toasting machine, microwave oven, convection oven and continuous worktop
- Buffet servery area
- Cash point, shelf, display back-fitment and trolley access
- Staff facility area
- Seated area (24 seats)

Equipment
- Hot water boiler
- Microwave oven
- Sandwich toasting unit
- Convection oven
- Wall mounted grill
- Hot plate and warming cupboard
- Automatic toasting machine
- Trolley storage units
- First Class trolley
- Second Class trolley
- Meal tray storage and distribution trolley
- Product and equipment trolley
- Buffet commodity and display trolley

The TSOB is fitted with a microwave and a boiler for provision of hot drinks.

Coach body structure

The coach body is an integral monocoque welded steel construction. The underframe comprises a longitudinal fabricated box section solebar either side of a corrugated floor supported on a number of cross members, a fabricated bolster above the bogie centres and a fabricated dragbox and headstock at each end to accommodate the coupler and buffers.

Bodysides are profiled sheets attached to longitudinal and vertical pressed framing members. The roof consists of a fabricated cantrail either side of a profiled corrugated sheet roof with a number of transverse diaphragm and intermediate carlines. Body ends comprise vertical door pillars outboard and vertical collision pillars either side of the gangway connected by a horizontal collision pillar above the gangway spanning the cantrail ends. The vertical pillars are covered by a flat skin either side of the gangway.

The components for the body are principally a combination of pressed, rolled or flat low carbon steel sheet, plate and standard sections. As such it can be readily modified for different uses, e.g. day coach, catering vehicle, or sleeper layout. Such modifications, and repairs to the structure can be carried out in conventional vehicle overhaul and manufacturing facilities.

The design is fully compliant with the structural loading requirements of UIC leaflet 566. Over and above those requirements it has demonstrated a high level of safety in terms of crashworthiness, its performance forming the basis of many of the UK's current rail vehicle energy absorption requirements.

Underframe

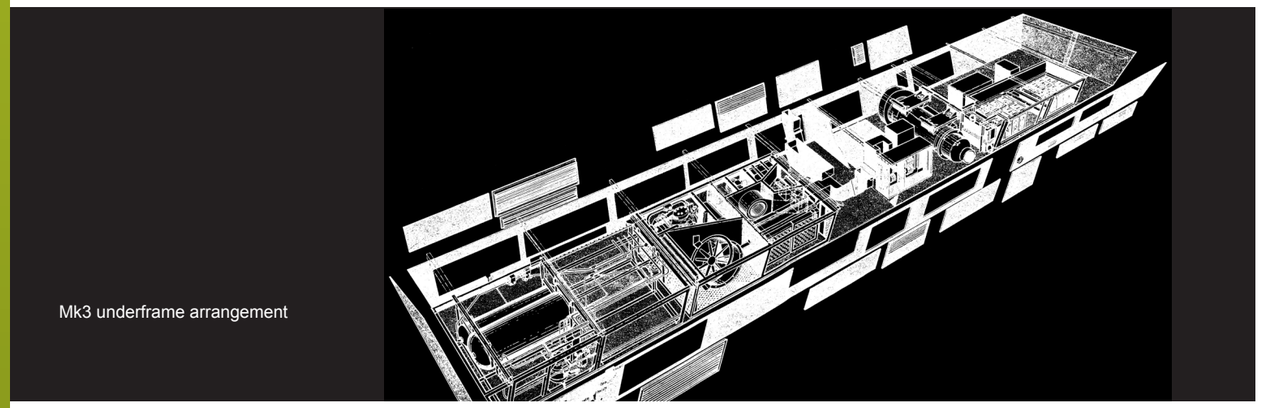
The underframe is extremely strong as it is utilised for both the bodyshell attachments and the suspension of all machines and equipment required for each coach.

The important aspect of the coupling arrangement is the ability to either auto couple to other coaches or attach directly to a locomotive with a standard drawhook.

The vehicles are fitted with buckeye auto couplers. These have lower shelf brackets fitted which limit relative vertical movements between couplers. The height of the coupler centreline above rail level is 991mm - 1003mm.

The buckeye coupling can be hinged down if necessary to permit coupling to locomotives which have a screw coupling arrangement.

Retractable buffers are fitted at both vehicle ends, and are of an oval shape measuring 560mm across the major axis. The distance between buffer centres measures 1752mm, and the height of the buffer centreline above rail is between 1046mm and 1066mm



Mk3 underframe arrangement

BT10 Bogie

The vehicle bogies are of the BT10 design, designed specifically for use with the Loco-Hauled and HST Mk3 vehicles. This provides a high level of passenger comfort and is based on an H-frame, box section fabricated steel frame. Not all bogies are the same; some are operable at 110mph (type-A) and some at 125mph (type-B).

HST bogies, although essentially the same design as the Loco-Hauled variant, are the type-A suitable for 125mph while Loco-Hauled vehicles have type-B and so are limited to 110mph. Modification is possible to allow them to operate at 125mph - principally the replacement of the drop-head drawgear.

In addition to the A and B variants, some bogies have short swing links to allow operation on the third rail network. Individual vehicle details are available if required.

Both A and B types' primary vertical suspension is provided by radial arm axleboxes with a single helical spring and viscous damper. The radial arm axlebox also provides the primary longitudinal control. A Lateral Control Rod arrangement between the axleboxes and the bogie frame provides the primary lateral suspension. In the case of a derailment, or if the bogie is lifted, the primary dampers will restrain the wheelset to the bogie frame.

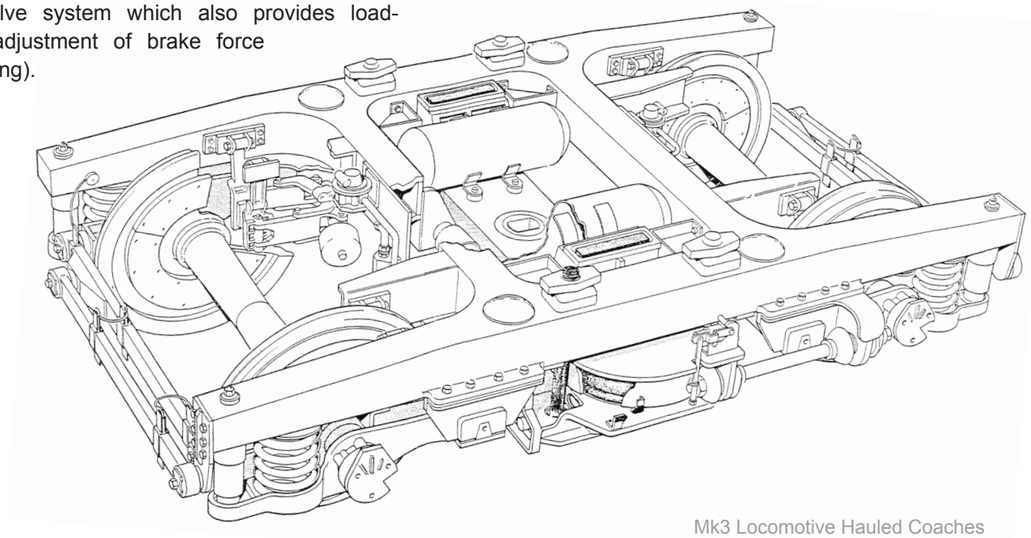
The secondary vertical suspension is provided with orifice-damped air springs, height controlled by a levelling valve system which also provides load-controlled adjustment of brake force (load weighing).

In the event of an air spring becoming punctured to the extent that most of the air pressure is lost, the pressure in the opposite air spring is automatically reduced and the bolster will rest on the bump stops. The vehicle can be run in this condition but will be required to have the air spring changed at the earliest possible opportunity.

The coach is fitted with isolating cocks which will isolate the air feed to individual bogies in the event of serious leakage occurring. Also fitted on the vehicle is an air suspension charging valve and the suspension reservoir.

The air springs are contained within a bolster and spring plank assembly supported from the bogie frame by swing links. Two air reservoirs on each bolster provide air for the suspension. The swing links utilise gravity to provide the secondary lateral suspension in conjunction with a lateral viscous damper. Longitudinal control is by traction rods between the bogie frame and the bolster.

The body is supported on the bolster through friction damped side bearers and a centre pivot arrangement locates the bogie transversely and longitudinally and accommodates bogie rotation. Additional roll stiffness is provided by an anti-roll bar system comprising a torsion bar attached to the bolster connected to vertical links attached to the spring plank. Joint articulation within the suspension is by means of elastomeric flexible bushes.



Systems

WiFi
The vehicles can be fitted with WiFi equipment to allow passengers to connect to the internet on their journey. The details of this facility would be agreed with the train operator to ensure all requirements and possible future expansion is catered for.

At Seat Power Supplies
Plug sockets can be provided to provide power for passenger equipment such as mobile phones and laptop computers. This requires the provision of a new power supply unit supplied from the M/A set or above-mentioned static converter.

Passenger Information System (PIS)
Fitting a PIS is essential for compliance with accessibility legislation from 2020 but is also much valued by passengers on any journey. Some HST vehicles have already been fitted with a BTROS-manufactured system and compatibility with this system is therefore preferred.

Apart from the legal requirement to display train destination and the next stop the system can be used to provide other information as specified by the train operator.

Electronic Seat Reservation
Currently a paper-based system is used for seat reservations however electronic systems are available. These are remotely fed reservation data for display on luggage-rack mounted indicators which show the portion of the journey the seat is available.

The Mk3 concept visuals shown earlier envisage use of a system which includes a coloured LED on every seat to provide an instant indication to passengers boarding and so reduce boarding times.

Saloon CCTV
CCTV monitoring equipment can be installed which normally includes 4 cameras and a recorder in every vehicle. Train operators can define definition and recording time to suit their requirements along with other options such as remote downloading, high definition or additional analysis functions.

Ethernet Backbone
The Ethernet backbone has fast become a vital component of the modern train.

As with its ground-based equivalents, Ethernet provides fast, efficient and reliable data transmission between any two points on a network. The hardware consists of a multi-channel jumper passing down the length of the train via a series of Ethernet switches, which can then be connected to Ethernet-enabled devices to create a flexible data network.

The prevalence of Ethernet in many other industries means that many electronic systems now come with Ethernet interfaces. This means that previously separate and proprietary systems can be interconnected and interfaced using a single transmission medium, opening up a range of passenger-environment and reliability-improvement possibilities.

Passenger WiFi is a widely-implemented example of a tangible application of an Ethernet backbone. Whilst WiFi has been fitted to some Mk3 vehicles without Ethernet, a greatly improved service can be offered when the system is approached as a whole.

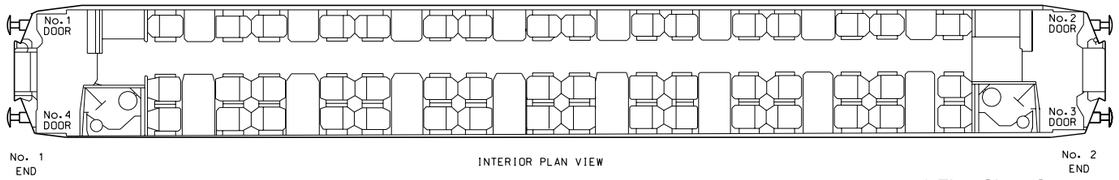
Passenger environment enhancements such as high quality information displays, automated public announcements and saloon CCTV systems can be fitted using an Ethernet backbone as a main infrastructure.

A major development in recent years has been the ability to retro-fit remote condition monitoring systems to existing stock. Condition monitoring uses the Ethernet backbone to collect data from both existing systems and additional devices to provide valuable monitoring, diagnostic and operational information to drive reliability improvements.

Porterbrook can offer a robust Ethernet backbone solution for the Mk3 enabling support of a wide range of applications which can be tailored to suit the operator's requirements. The ideal time to fit such a system is during refurbishment works.

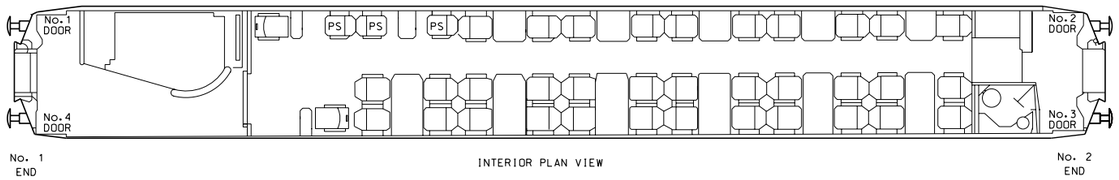
Vehicle Layouts

FO Vehicle



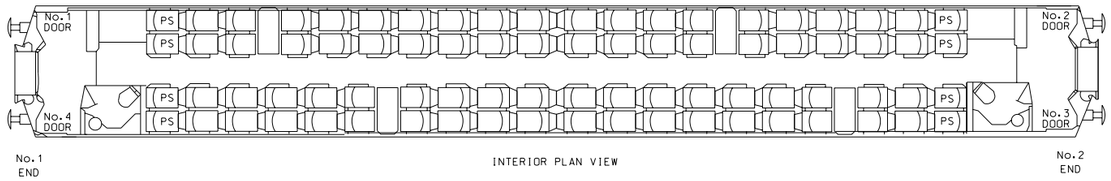
48 First Class Seats
2 Toilets

FOD Vehicle



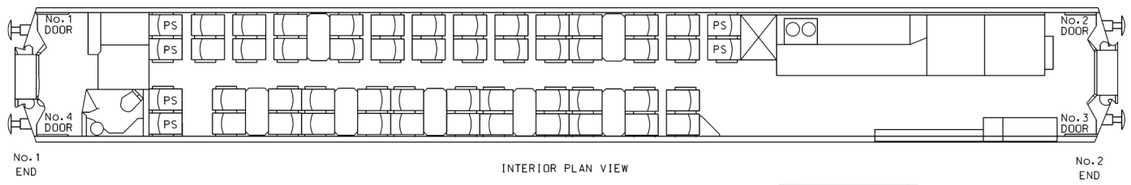
37 First Class Seats (inc 3 Priority Seats)
1 Wheelchair Position
2 Toilets (1 x Standard, 1 x Accessible)

TSO Vehicle



80 Standard Class Seats (inc 8 Priority Seats)
2 Toilets

TSOB Vehicle



52 Standard Class Seats (inc 6 Priority Seats)
1 Toilet
Catering Area

Seating

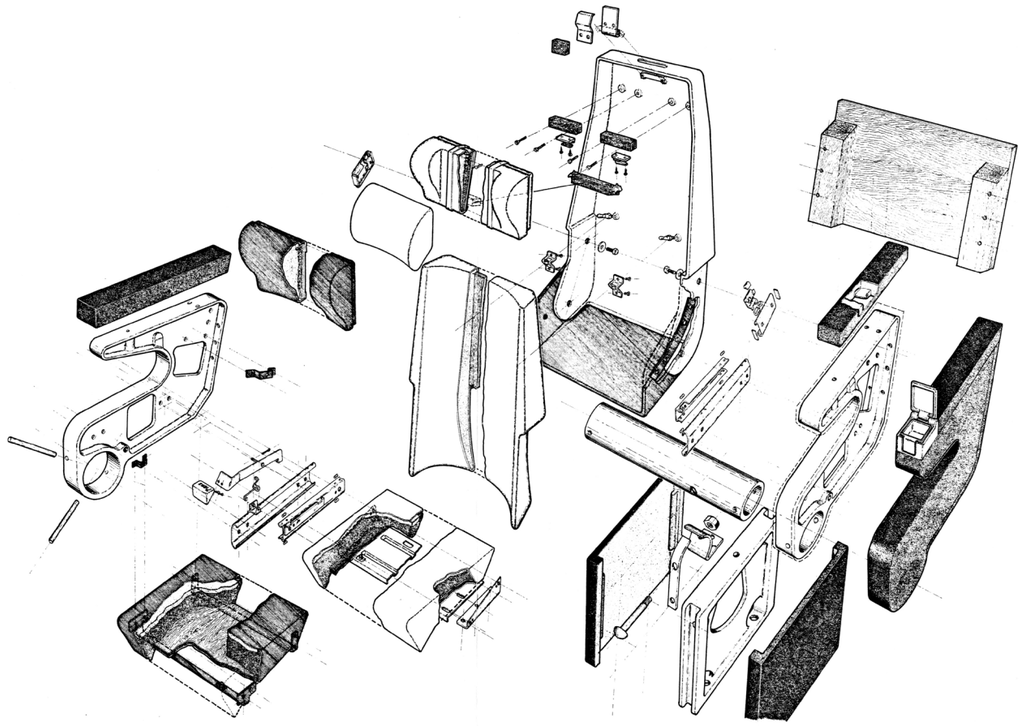
In Standard Class a seating bay (around a table) measures 1883mm along the length of the vehicle, and “airline” (face-to-back) seat pitch measures 949.5mm.

In First Class, a seating bay (two seats with a table) measures 2130mm.

All seats are provided with armrests and individually shaped seat cushions and headrests. First Class seats are reclinable. The trim profile has been designed to meet the highest possible comfort conditions. Seat covers are removable for cleaning, repair or replacement.

The seats on Mk3a vehicles are supported by a main tube situated below the front edge of the cushion. This tube is attached to a rail on the bodyside and supported by one leg onto a similar rail on the floor.

Mk3b First Class seats fit onto the same bodyside and floor rails but the support is of a welded spaceframe design and are fitted with chrome plated padded armrests.



Interior Crashworthiness

Any major changes made to vehicle interiors are now subject to compliance with GM/RT2100, thus ensuring the safety benefits available are taken up where this is possible.

This is primarily designed to reduce the effect of secondary impacts on passengers in an incident by ensuring there are no sharp corners or loose items likely to cause injury in such a situation.

The requirements of the new standard will require more testing and modelling than has been the case before and may restrict the possibilities of more open layouts.

Saloon Layout

Existing First Class saloon vehicles typically have 48 seats in a 2+1 arrangement either side of a central aisle, configured in bays around fixed tables.

Existing Standard Class saloon vehicles typically have 74 seats in a 2+2 seating arrangement either side of the central aisle, configured in a mixture of bays around fixed tables, and face-to-back (airline) with fold down tables on the rear of the previous seat.

Gangway width is 412mm in Standard Class, and 619mm with in First Class.

All vehicles have ample luggage storage facilities throughout the length of the coach on the overhead racks, and between the backs of bay configured seats. There is a large luggage stack at each end of all vehicles (except for catering vehicles, and vehicle ends fitted with a disabled accessible toilet).

Typically, 2 toilets are provided at vehicle ends.

Seating Options

The UK railways’ stringent requirements for crash safety and fire testing, together with the mainland-European seating supplier base, mean there are a limited number of compliant seats available ‘off-the-shelf’.

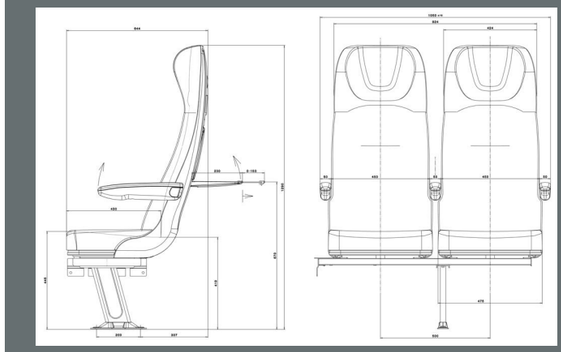
New seats are always higher-backed than the existing seats as a result of crash-safety requirements. Whilst new seats often allow tigher pitches, hence allowing more seats to be fitted in a given space, a balance needs to be defined to ensure this is not at the expense of passenger comfort.

Some refurbishments choose to reuse the existing seat, replacing seat foams and covers to maintain the open nature of the saloon, and the comfort of the existing seat.

A number of new seats have been used successfully in Mk3 refurbishments, and examples are shown in the panel.

Grammer IC3000

Grammer’s IC3000 is a popular seat used widely in UK rail refurbishments. Most relevantly, this was used on Standard Class interiors of First Great Western’s HST Mk3 refurbishment.



TBM Rail / Primarius Seating

Primarius (now licenced to TBM Rail) seats were used on GNER and Arriva Cross Country HST Mk3 refurbishment.

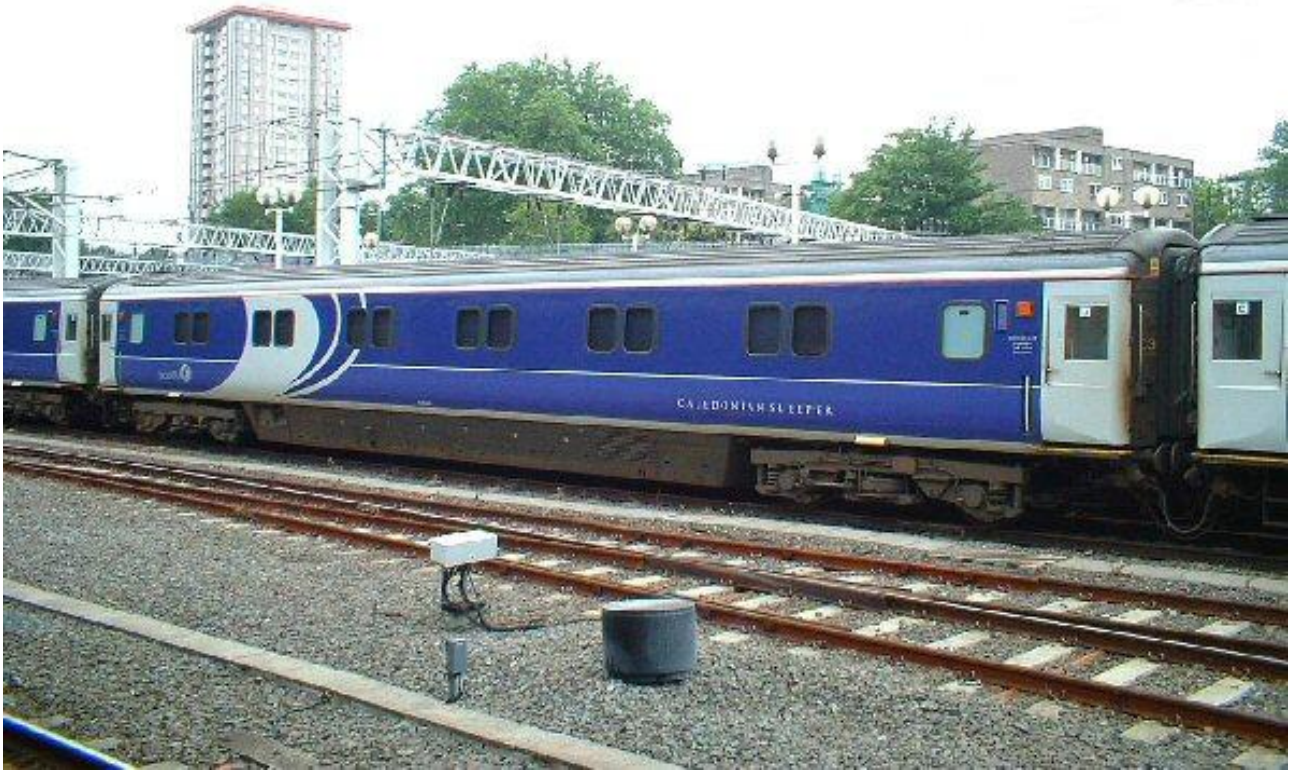
Mk3

Train Operator/s	**National Express East Anglia, National Express East Coast, First Great Western, Virgin West Coast, ScotRail**

Vehicle Qty	174
Consist	NXEA x 122, NXEC x 28, FGW x 10, VWC x 12, ScR x 2
Traction Type or Power Supply Type	Loco-hauled trailer cars and caterers
Max Speed	125 mph

The Mk3 coach is widely viewed as the best passenger vehicle the UK ever produced. Weighing in at only 34 tons, the vehicle offers an excellent ride on BT10 air-suspension bogies along with good sound insulation. Many vehicles are now available, having been replaced by new “Pendolino” trains on the West Coast route. Other vehicles have been refurbished for use on One Anglia to operate the London – Norwich service with Class 90 and DVTs. The coaches have wide “slam” doors, protected by central door locking from accidental opening. Interior doors are powered and luggage stacks are provided. Construction is all steel with standard buffers and gangways.

Mk3 Sleeper



Train Operator	ScotRail

Vehicle Qty	53
Consist	Loco-hauled trailer car - 6 x SLE, 12 x SLED, 35 x SLEP
Traction Type or Power Supply Type	None
Max Speed	100 mph

This variant of the Mk3 coach was built in the early 1980s to work all the sleeper services then running. The number of these services was subsequently reduced leaving spare vehicles. Many of these have been scrapped although around 20 remain off lease. The majority of these vehicles operate the London – Inverness sleeper service, their refurbished interiors providing comfortable facilities and the HST – style bogies a comfortable ride. Some vehicles provide catering and lounge facilities further contributing to the impression of a moving hotel.

British Rail Mark 3

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British Rail's third design of standard passenger carriage, designated 'Mark 3' (also described as Mark III), was developed in response to growing competition from airlines and the motorcar in the 1960s. A variant of the Mk3 became the rolling stock for the High Speed Train or Inter-City 125,

Originally conceived as locomotive-hauled coaching stock, the first coaches built were for the prototype HST in 1972. Production coaches entered service between 1975 and 1988, and multiple-unit designs based on the Mark 3 bodyshell continued to be built until the early 1990s. The Mark 3 and its derivatives are widely recognised as a safe and reliable design, and most of the surviving fleet is still in revenue service on the British railway network in 2013.

Contents [hide]

Introduction [edit]

In the late 1960s British Rail had modernised its rolling-stock fleet on its key long-distance routes with the introduction of the air-conditioned Mark 2 coach, and was implementing extensive plans to alter track geometry and rework slow sections of track with the aim of decreasing journey times and improving passenger comfort; however, the railway continued to lose passengers to car and air. The "Inter-City" brand was created to show off these improvements, including the electrification of the West Coast Main Line (Glasgow, Preston, Manchester, Liverpool to London Euston) and new air-conditioned versions of Mk 2 coaches. Elsewhere the French, German and Italian railways were steadily electrifying their main routes and providing new, comfortable and smooth-running rolling stock, while in Japan the new purpose-built Tokaido line was opened with 125 mph air-conditioned rolling stock.

Under the chairmanship of Sir Stanley Raymond, it was decided to reduce journey times further on long-distance trains by increasing line speed to 125 mph where practical - the maximum considered possible on Britain's Victorian-age railway. At the end of 1968 proposals were submitted to the Commercial and Operating Departments of British Rail for a new fleet of third-generation standard coaching stock, designed to run at 125 mph.[1]

The rapid development required for the Inter-City 125 High Speed Train (HST) in 1969 made the Mk 3 coach design the obvious choice for this train, and in 1972 the first Mk3 coaches were built; 10 for the prototype HST.

Construction [edit]

The Mark 3 looks similar to Mark 2D, 2E and 2F coaches, but is of a completely different design. A difference aiding quick recognition is the ridged roof of the Mark 3 and under-frame skirt compared with a smooth roof and visible below-frame equipment on the Mark 2.

The bodyshell is 75 feet (23 m) long, almost 10 feet (3.0 m) longer than the Mark 2, of full monocoque construction with an all-welded, mild steel, stressed skin, and has gained a reputation within the railway industry for its exceptional strength and crashworthiness. Another important advance over its predecessor was the adoption of secondary air suspension between the body and the bogies, giving an exceptionally smooth ride. The bogies, classified BT10, were designed specifically for the Mark 3 and have coil-spring primary suspension with hydraulic dampers, enabling a maximum speed of 125 mph (200 km/h) — the Mark 2 is limited to 100 mph (160 km/h). Disc brakes in place of the Mark 2 design of clasp brakes completed the engineering package - enabling efficient deceleration from 125 mph and almost silent brake operation.

British Rail Mark 3

British Rail Mk 3 in Wrexham & Shropshire livery at Marylebone station.

The interior of a British Rail Mark 3 carriage in CrossCountry livery

In service	1975- present
Manufacturer	BREL
Built at	Derby (Litchurch Lane)
Constructed	1975 - 1988
Number built	848 vehicles
Operator	Arriva Trains Wales Chiltern Railways CrossCountry Direct Rail Services East Coast East Midlands Trains First Great Western First ScotRail Grand Central Railway Greater Anglia Network Rail Virgin Trains
Line(s) served	East Coast Main Line West Coast Main Line Midland Main Line Great Western Main Line Great Eastern Main Line Cross Country Route Chiltern Main Line

Specifications

Car body construction	Steel Fully Integral, monocoque
Car length	23 metres
Doors	Hinged slam, centrally locked/automatic plug doors, centrally locked
Maximum speed	125 mph (200 km/h)
Power supply	3-phase 415/240V (Mark 3) 1000V DC (Mark 3A/B)
Bogies	BREL BT10
Braking system(s)	Disc, pneumatic
Track gauge	1,435 mm (4 ft 8½ in)

Ancillaries such as electrical and air-conditioning systems were grouped together in discrete modules housed behind an aerodynamic skirting between the bogies; on the Mark 2 these were mounted above and below the passenger seating area. The lighting and air-conditioning fittings were for the first time integrated into the ceiling panels. Other new features (first seen on the Mark 2F) were the pneumatically operated automatic gangway doors which were triggered by pressure pads under the floor. A speed-operated central door-locking system for the manually operated slam-doors was installed in the Mark 3 stock from 1993.

The main difference between the HST vehicles and the loco-hauled Mark 3A relate to electrical supply arrangements. HST Mark 3 coaches take an industrial voltage/frequency 3-phase supply directly from an auxiliary alternator in the power car to supply on-board equipment such as air conditioning. The loco-hauled vehicles take a standard single-phase 1000 V AC or DC train heat supply from the locomotive and convert it through motor generator units located under the floor. These convert the train supply to 3-phase 415/240 V 50 Hz AC to power air conditioning and other ancillaries. This makes the two types non-interconnectable in service conditions. The other main difference is the lack of buffers on HST coaches.

The later Mark 3B build provided additional 1st-class loco-hauled vehicles for the West Coast Main Line. These are virtually the same as earlier Mark 3As, but have an improved motor alternator unit with compound-wound motor, and seating derived from the Advanced Passenger Train (APT).

Prototype [edit]

10 coaches were constructed to run between a pair of Class 41 power cars as the prototype HST (prototype InterCity 125), exploring different seating and layout options for first- and second- class passengers, and evaluating different designs of catering facilities. In 1973 the prototype HST was evaluated during passenger operation in an 8-coach formation between power cars. The two spare coaches were rebuilt and redeployed into service in the Royal Train (coaches 2903 & 2904), where they remain in use today.

Main article: Prototype HST

Development [edit]

Initial plans for a large fleet of Mk3 loco-hauled coaches to run almost all Inter-City services were amended prior to construction to provide stock for the planned HST / InterCity 125 fleets, resulting in a much smaller fleet of Inter-City loco-hauled coaches for West Coast Main Line (WCML) services. Overall a much reduced number of coaches were manufactured, requiring many Mark 2D, 2E and 2F coaches to remain in front-line service.

The table below lists manufacturing variants as built, showing the quantity of each type/designation and original running numbers.

Mark	Built	Features	Numbers Built : No., TYPE, (Original Number Series)	
Mark 3	1972	prototypes	1 x RSB (10000) 1 x RUK (10100)	4 x FO (11000-11003) 4 x TSO (12000-12003)
Mark 3	1976-82	standard HST stock (no buffers)	37 x TRSB (40001-40037) 58 x TRUB (40300-40357) 20 x TRUK (40501-40520)	167 x TF (41003-41169) 339 x TS (42003-42341) 102 x TGS (44000-44101)
Mark 3A	1975-84	standard locomotive-hauled stock	28 x RFB (10001-10028) 120 x SLEP (10500-10619) 88 x SLE (10646-10733)	60 x FO (11004-11063) 165 x TSO (12004-12168) 2 x Royal (2914–2915)
Mark 3B	1985-88	later locomotive-hauled stock with improved interior lighting diffusers, InterCity 80 seats and other upgrades	38 x FO (11064-11101) 3 x BFO (17173-17175)	52 x DVT (82101-82152) 2 x Royal (2922–2923)

Key: See British Railway Coach Designations for details of the meaning of RSB, TRUK, BFO etc.

Usage [edit]

The Mark 3 design proved to be highly adaptable for use in BR's multiple-unit stock of the 1980s, with the following classes having Mark-3-based bodyshells:

- **AC EMU Classes**
  - Class 317
  - Class 318
  - Class 319
  - Class 320
  - Class 321
  - Class 322
- **DC EMU Classes**
  - Class 442
  - Class 455
  - Class 456
- **DMU Classes**
  - Class 150
  - Class 210

A picture of a Virgin Trains' MK 3 carriage at Crewe station in 2000. It is in its former Intercity livery.

The Mark 3 bodyshell was also used as the basis for Northern Ireland Railways' 450 Class DMU.

Since 1977, the Royal Train has used nine specially equipped Mark 3 coaches. Some of these were rebuilt from the original HST prototype vehicles.

Grand Central, an open-access operator on the ECML, uses HST sets on its services between London and Sunderland.[2] The Mark 3 coaches were of the loco-hauled type, and had to have their couplers and electrical systems modified to make them compatible with Class 43 power cars.

Mark 3 coaches also still have a limited role on the WCML as sleeping cars on the overnight Caledonian Sleeper services between Scotland and London Euston.

The introduction of Virgin Trains' Pendolino electric multiple units on the WCML caused a large surplus of Mark 3 vehicles, which ended up in storage at Long Marston. Some former Virgin coaches were refurbished and cascaded to the Great Eastern Main Line, replacing Mark 2E/2F vehicles on London-Norwich services.

CrossCountry has reinstated HSTs on the CrossCountry franchise in response to criticism of the lack of seating capacity on the Voyager DEMUs used by previous incumbent Virgin Trains. To satisfy demand for these new HST sets, it is anticipated that more loco-hauled Mark 3 coaches will need to be converted for HST operation.

HSTs also continue to be used by First Great Western on the Great Western Main Line, by East Midlands Trains on the Midland Main Line, and by East Coast on the East Coast Main Line.

Virgin has retained at least one complete Mark 3 set with a Class 90 locomotive—initially used to cover peak-time Euston-Birmingham services while the Pendolinos underwent modifications, but it is now covering the loss of 390033 which was written off after the Grayrigg derailment in 2007. In July 2009, Virgin refurbished this set—repainted into the Pendolino silver/black livery to bring it in line with the newer fleet, with the interiors receiving power sockets at every seat, the addition of WiFi, and new seat covers and carpets in the same style as the Pendolino and Voyager fleets, but the BR vintage seats and interior fittings remain. This set is nicknamed the "Pretendolino".

In January 2007, the first of the refurbished Mark 3 sets for the ECML were unveiled by previous franchisee GNER. These have been internally refitted to the same standard as the "Mallard" Mark 4 stock with the same styles of seating and lighting. The new Mark 3 Mallards were converted by Wabtec in Doncaster, and the final refurbished set entered service in October 2009.

Cargo-D, a rolling-stock logistics company, acquired 18 ex-Virgin West Coast Mark 3 coaches and repainted them in their original British Rail blue/grey livery and Inter-City branding—the first time this had been seen since the late 1980s. The stock was used primarily for the company's own "Rail-Blue" charter operation and on lease to the now-defunct Wrexham & Shropshire (see below). Cargo-D went into administration in October 2011.[3]

Wrexham & Shropshire, an open-access operator, introduced four of its own rakes of refurbished Mark 3 coaches hauled by a Class 67 locomotive for its services between London and Wrexham. After the collapse of Wrexham & Shropshire, these rakes are now used on Chiltern Railways services between London Marylebone and Birmingham Moor Street. Chiltern is now in the process of acquiring more Mark 3 coaches.

These developments will ensure that the vast majority of the Mark 3 fleet will be back in revenue service, reducing the possibility that a large number of the coaches may end up exported or scrapped. As a result of British Rail's over-provision of stock for sleeper services now long withdrawn, two-thirds of the Mark 3 sleeping-car fleet were either stored or scrapped.

Mark 3 sleeping car at the Colne Valley Railway

Sewage discharge [edit]

Legally in the UK, train operators are allowed to discharge 5 imperial gallons (23 l; 6.0 US gal) of sewage per carriage per journey on to the track. Most Mk3 carriages have only holding tanks, not fully compliant toilet tanks. However, in the 2000s both the RMT trade union and politicians were concerned at the environmental impact of this legacy issue. The problem was first raised in 2003 after Railtrack staff at Nottingham abandoned local clean-up and then track maintenance procedures due to an excessive built up of sewage waste in the area.[4] In 2006 the RMT agreed waste tank and clean-out developments at Northern Rail's Heaton depot in 2006 with GNER, plus new clean-out procedures at all other depots, to solve an ongoing dispute over the previous 18 months.[5] By 2011, the European Union had started a formal investigation to see whether trains composed of such carriages were breaking EU environmental and health laws, although the Environment Agency confirmed that train companies claimed special exemptions to dump waste along the tracks.[6] In 2013, Transport Minister Susan Kramer branded the practice "utterly disgusting" and called on the industry to take action. ATOC responded by stating that, as all new vehicles had to be fitted with compliant toilet tanks, withdrawal of the HSTs by the end of 2017 would solve the problem.[7]

Variants [edit]

HST vehicles [edit]

Original formation [edit]

The original Mk3 coaches delivered as part of HST sets for Western Region (Class 253) contained Trailer First (TF), Trailer Second (TS), and Trailer Buffet Second (TRSB) variants in formation TF-TF-TRUK-TS-TRSB-TS-TS. Complaints from train guards about engine noise in the guards' compartments in the power cars led to an additional variant, the Trailer Guard Second (TGS) in 1980, based on the TS but with the end vestibule and one seating bay replaced by a guard's compartment. This replaced the last TS in all sets from 1980 onwards. Sets delivered for Eastern Region (Class 254) contained 8 coaches, originally in formation TF-TF-TRUK-TS-TS-TRSB-TS-TS. The TRUK cars were quickly replaced by a TS on the Western Region and most had been replaced on the Eastern Region by 1985 (many later rebuilt into loco-hauled buffet cars). TRUB cars (Trailer Restaurant Unclassified Buffet) were newly built from 1978, to replace the TRUK cars, and these were reclassified as TRFB (Trailer Restaurant First Buffet) from 1985 on the Eastern and Midland Regions and from 1989/90 on the Western Region.

Previous formations [edit]

Virgin Trains frequently operated HST sets in shortened formations between 2001 and 2004, the most common being five-car sets. This gave the trains better acceleration, so as to be similar to the Voyager units.

Current formations [edit]

Most operators of HST sets form them in eight-car sets, with East Coast operating nine-car sets, with an additional standard-class vehicle. The exceptions are CrossCountry, which operates seven-car sets with only one first-class car and a simplified buffet car; First Great Western, which operates some seven-car "high-density" sets with micro buffets and with more seats in each car on express services to Oxford; and Grand Central, which operates its HSTs as five-car and occasionally six-car trains.

Hauled stock [edit]

Mark 3A coaches were deployed on WCML expresses out of Euston to bring the three main long-distance routes from London up to the same standard. Initial variants were Second Open (TSO) and Open First (FO). Catering and sleeper vehicles continued to be Mark 1 stock until the

introduction of Restaurant Buffet (RUB) vehicles in 1979-80, and the sleeper (SLEP) vehicles in 1981-82. In 1988 the process was completed with the elimination of Mk 1 parcels vehicles and their replacement by Mk 3-derived Driving Van Trailers, making the WCML push-pull.

Scottish Region push-pull services were initially made up of four TSO and one FO Mark 3A coaches with a Mark 2F DBSO. This was later changed when the FO was converted to a CO by the declassification of half a coach and installation of a partition between the two classes. An SO was removed from the formation. These vehicles were removed from the Scottish regional routes in 1989 when they were replaced with Class 158 multiple-unit stock.

Entertainment carriages [edit]

In 2009 First Great Western introduced 'entertainment carriages' fitted with at-seat television screens known as Volo TV. The system, which FGW claims is a "world first", is usually fitted to D-coach standard-class carriages.[8] The service, originally charged for, is now free, but users have to provide their own headphones (standard 3.5mm stereo mini-jack plug) or purchase a pair from the cafe for £1.50.[9]

In addition to radio and video feeds, a GPS train-location screen is provided allowing passengers to check the progress of their journey in real time. Externally an aerial has been fitted to the roof of these coaches.

The Volo TV system fitted in some of the carriages

Multiple units based on the Mark 3 [edit]

The Mark 3 formed the basis of BR's *Second Generation* multiple unit fleet, introduced from the early 1980s onwards.

Electric multiple units include the 25 kV AC EMUs of the Class 317 and Class 318, and the 750 V DC EMUs of the Class 455 and Class 442. Also with a dual-voltage EMU which is the Class 319. Diesel multiple units include the short-lived diesel electric Class 210, and the diesel-mechanical "Sprinters" of the Class 150. The cars for Classes 150, 210, 317, 318 and 455 units are built on 20 m frames, and are outwardly similar. However, those for Class 442 are on 23 m frames, and visually look very similar to the familiar HST mark 3 coach. The main visual difference is the use of swing plug automatic doors rather than the traditional "slam-door" as used on HST stock. The Class 153 and Class 155, while of the "Sprinter family", are in fact built by British Leyland and have nothing to do with the Mk 3 carriage. This is also true of the Class 156, built by Metro-Cammell. The final batch of "Sprinters" of Class 158 (some rebuilt as Class 159) are of a design intermediate between that of the Mk 3 and the later Mk 4. In addition, a fleet of nine 450 Class DMUs were built at Derby for Northern Ireland Railways using Mark 3 bodyshells and Mark 1 underframes, together with refurbished power units and traction motors, recovered from the former UTA 70 class units. The last Mark -3-based EMUs built are the Class 321 and 322 units.

v · t · e	**BREL Mark 3-derived family**	[show]

Mark 3 coaches overseas [edit]

The Mark 3 in Ireland [edit]

A Mark 3 standard coach pictured at Heuston Station, Dublin, in Intercity livery

The Republic of Ireland's national rail operator, Iarnród Éireann, ordered a fleet of Mark 3 carriages built between 1984 and 1989, with bogies to fit the Irish gauge of 1600 mm (5 ft 3 in). The fleet consisted of 124 Mark 3 and nine Mark 3A internationals which worked only the Dublin-Galway service, branded "Cú na Mara" or "Hound of the Seas" as it was a coast-to-coast route.

Throughout the 1990s and 2000s, they were the backbone of the intercity rolling stock on the Irish railway network.

All of these coaches were built with automatic plug doors, which initially caused some concern as additional time and resources were required to perfect them. The design of these doors was later used on the Class 442 "Wessex Electrics". Most of the fleet was air-conditioned, except for a small number of coaches built originally as outer-suburban stock which ran in push-pull configuration. A number of coaches were first class, and there were several dining cars as well as five driving van trailers (DVTs) which included passenger seating. There were also a number of accompanying generator vans for supplying power.

In 2006/7, new carriages built by CAF of Spain (referred to in Ireland as Mark 4 stock) were introduced on the important Dublin-Cork route. The displaced Mark 3 coaches were then cascaded to other intercity routes.

However, in 2008 Iarnród Éireann began taking delivery of Korean-built 22000 Class railcars, which ultimately led to withdrawal of all Mark 3 coaches. The type's final service was a Dublin-Cork relief train on 21 September 2009.

Post-withdrawal in 2009 a number of efforts were made to sell some or all of the 130 carriages in the Iarnród Éireann inventory but some are still stored in various locations.[10][11][12]

See also [edit]

- InterCity 125
- Class 43 power cars
- Coaching stock of Ireland
- Class 442 EMU

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Sleeper Either Class

From Wikipedia, the free encyclopedia

A **Sleeper Either class** (**SLE**) and **Sleeper Either class with Pantry** (**SLEP**) are a type of railway sleeping car used in the United Kingdom. Some units were later modified for better wheelchair access as **Sleeper Either class Disabled** (**SLED**). A smaller number reused in Denmark were classified as **WLABr**.

A total of 208 vehicles were built at Derby Carriage and Wagon Works by British Rail Engineering Limited between 1982–1984 to the British Rail Mark 3A profile for British Rail. They were introduced to replace an ageing fleet of Mark 1 vehicles sleeping cars built to various designs and which dated from the late 1950s to early 1960s. The order consisted of 90 SLE variants, numbered 10646–10734, were constructed with thirteen bedrooms each, and 118 SLEP variants, numbered 10500–10617 constructed with twelve bedrooms with the last compartment used for an attendant.

As of 2006, the only mainline operators of these type of carriages are First Great Western on the Night Riviera and First ScotRail on the Caledonian Sleeper.

With the decline of overnight sleeper services in the United Kingdom shortly after their introduction at the end of the 1980s, many of the carriages later were moved to heritage railways to provide sleeping accommodation for heritage staff and volunteers.

Service [edit]

SLEP 10590, at Penzance railway station on 29 August 2003 as part of the Night Riviera

On the Night Riviera from London Paddington station to Penzance railway station in Cornwall.

The various Scottish services depart from London Euston railway station for final destinations at Glasgow Central station, Edinburgh Waverley railway station, Aberdeen railway station, Inverness railway station and Fort William railway station.

Between 1988–1998, ten SLE carriages were leased to Danish State Railways (DSB) for use in Denmark. This lease came to an end following the opening of the Great Belt Fixed Link combined bridge and tunnel. During this time, the vehicles were classified as WLABr and each carried a UIC number.

British Rail Sleeper Either Class

Providing accommodation at a heritage railway

In service	1982–
Manufacturer	British Rail Engineering Limited
Built at	Derby Carriage and Wagon Works
Family name	British Rail Mark 3
Constructed	1981–1984
Number built	208 (118 SLEP, 90 SLE)
Fleet numbers	SLEP: 10500–10617, SLE: 10646–10735
Capacity	SLEP: 12–24 beds (12 compartments), SLE: 13–26 beds (13 compartments)
Operator	See article text
Specifications	
Car length	75 ft 0 in (22.86 m)
Maximum speed	125 mph (200 km/h)
Weight	43 t (42 long tons; 47 short tons)
Train heating	Electric heating (ETH index SLEP: 7, SLE: 6), air conditioned, electric cooking
Bogies	BT10
Braking system(s)	Air
Track gauge	4 ft 8½ in (1,435 mm)

Carriage stock of British Rail [hide]

Passenger carriges	**Mark 1:**	BCK · BFK · BSK · BSO · BSOT · CK · FK · FO · RB · RBR · RF · RKB · RMB · RU · SK · SLC · SLEP · SLF · SLSTP · SO · TSO ·
	Mark 2:	BFK · BSK · BSO · BSOT · BUO · DBSO · FK · FO · FOT · PFB · PFK · PFP · RFB · RLO · RMBF · RSS · SK · SO · TSO · TSOT ·
	Mark 3:	BFO · CO · FO · RFM · **SLE** · **SLED** · **SLEP** · TSO · TSOB - (Locomotive-hauled) · TF · TGS · TRB · TRFB · TRFK · TRSB · TS - (InterCity 125 trailers) ·
	Mark 4:	FO · RBF · RSB · TSO · TSOD · TSOE - (InterCity 225 trailers) ·
Non-passenger carrying carriage stock (NPCCS)	**Mark 1:**	BG · BPOT · BV · Courier · CCT · GUV · PCV · POS · POT · TCV ·
	Mark 3 & Mark 4:	DVT ·

British Rail coach designations · British carriage and wagon numbering and classification ·

Categories: British Rail coaching stock | BREL products | Night trains

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