CHAPTER 2 ELECTRIC RAILCARS FOR THE GENERAL ROCA LINE

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2-1 Electric Railcar Outline

Electric trains are composed of two types of rolling stock: the motor car with a driver's cab (Mc) and trailer (R) equipped with a pantograph and such high voltage devices as a vacuum circuit breaker, main transformer, main rectifier, etc. This train is a fixed three-car unit, Mc-R-Mc. The total length is 75 m. The car dimensions are: car length 25 m, maximum width 3.136 m, and maximum height above rail level 4.080 m.

The train formation is shown in Fig. 2.1.1, and rolling stock dimensions and rolling stock gauge are shown in Fig. 2.1.2.

The ATS device has been attached to trains as a safety device for the first time in Argentina.

A total of 52 units or 156 cars will be manufactured for 1st Step commercial operation on the General Roca Line. Of these, 36 Mcs will be of Argentine make and the remainder of the 120 cars will be of Japanese make.

The basic design prerequisites for these railcars are:

(1) AC 25kv, 50 Hz, overhead contact wire system
(2) Three-minute headway, 120km/h operation
(3) Mc-R-Mc fixed unit, maximum three-unit, nine-car operation
(4) Design to match surroundings
(5) Incombustible materials
(6) Adoption of state-of-the-art technology, cost reduction, and economical maintenance
(7) Taking into account production in Argentina
(8) Consumables (especially brake shoes, disks, and the like) to be procured in Argentina
(9) Outside plates composed of copper-steel alloy

Motor car with driver's cab (Mc) Trailer (R) Motor car with driver's cab (Mc)

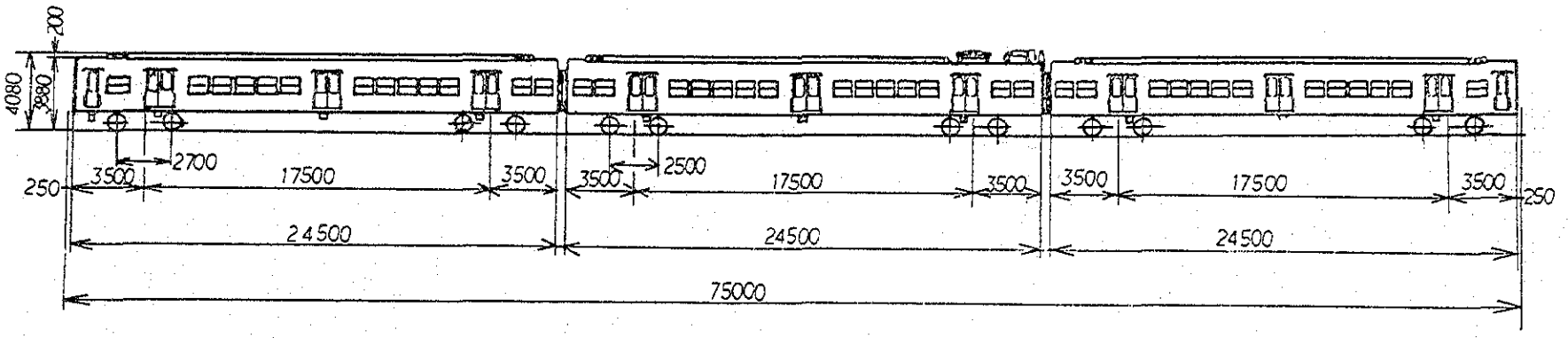


Fig. 2.1.1 Train Formation

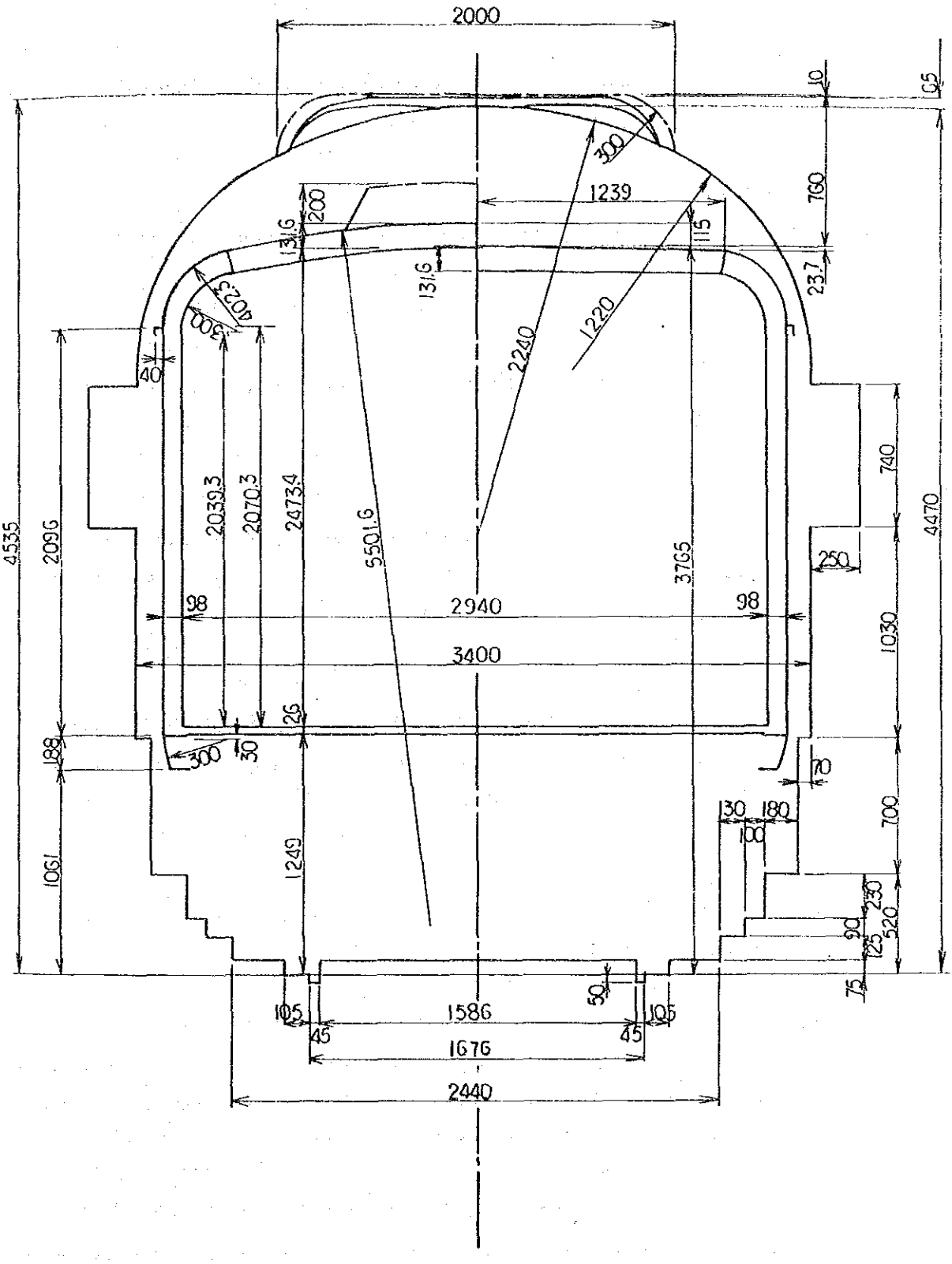


Fig. 2.1.2 Rolling Stock Dimensions and Rolling Stock Gauge

2-1-1 Car-bodies

(1) Front shape

Gangway doors are adopted in consideration of passengers' exit in emergencies and multiple-unit formations.

(2) Car-body colors

The basic color is cream with vermilion and green stripe around the midsection.

(3) Car-body construction

Car-bodies are all steel, welded construction with outside plate of copper-steel alloy.

(4) Floor construction

Floors consist of keystone plate of 13 mm copper-steel alloy for floor plate, "Unitex E" for shock-absorbing cushion, and 3 mm polyvinyl chloride resin polished for floor covering.

(5) Interior colors

The colors are pearl gray for ceiling board, light cream for side and end plates, gray for passage carpets, and light gray for other carpets. As a whole, warm colors are adopted.

(6) Ceiling

Ventilation fans (intake type) are installed in the ceiling, eight sets in Mc and seven sets in R.

(7) Side windows

Windows are of the unit-assembly type, the upper half opened by lowering and the lower half opened by raising. In addition, a louver window (raising type) of aluminum alloy is used.

(8) Side entrances

In order to facilitate their use as commuter trains, three entrances are installed on both sides, each consisting of double sliding doors.

(9) Seats

All seats are walkover-type cross seats, except for single seats by the entrance and the seats for two persons fixed on the end plate. The conductor's room is furnished with a long seat and is available to passengers in case the leading Mc is situated in the middle of a train formation.

2-1-2 Driver's Cab

(1) Destination display device

The destination display device is installed in the upper cover of the gangway.

(2) Taillights and position lights

Taillights and position lights are installed in the upper covers of the front end and back end windows.

(3) Pilot lamps

Two pilot lamps are installed on the driver's desk, one for door operation and the other for fault indication. Other pilot lamps are arranged on the upper part.

(4) Electric heater for driver's cab

An electric heater is installed by the driver's feet.

(5) Master controller, brake valve, switches and gauges

Master controller is installed at the driver's front left and brake valve at his right. Switches are installed on the wall of driver's left hand side and gauges and the ATS indication lamp, etc. are installed on his right hand side.

(6) Hand brake

A hand brake handle and brake-release indicator are installed on the side opposite the driver's side of the cab.

(7) Switch board

A switch board is installed on the back wall of the side opposite the driver's side of the cab.

2-1-3 Bogies, Driving Gear, and Traction Motors

(1) Bogies

Both Mc and R bogies are of the swing-bolster-hanger type, 2-axle bogies.

(2) Bogie frame, upper-swing bolster, lower-swing bolster

Bogie frames are partially welded and assembled of guide-bent steel plate with swing bolster guides operating on the swing-bolster-shoe method.

(3) Spring gear

Coil springs are used for bolster and axle springs.

(4) Wheels and axles, axle boxes

Mono-block type wheels are used. Axle bearings are spheroidal roller bearings. Pedestal wear plate type axle-box guides are used.

(5) Fundation brake gear

Traction bogies have tread brakes with built-in automatic slack adjusters. Trailer bogies have high-capacity disk brakes.

(6) Driving gear

The parallel cardan system is adopted for driving gear. A WN coupling type transmission system is used.

(7) Traction motors

F-type insulation and long-size carbon brushes are used. Bearings are of the midterm oiling type. Inspection windows are installed on the commutator, one on the upper side and another on the lower side.

2-1-4 Underfloor Equipment

(1) Trailer

The trailer has equipment for current collection, transformation, and rectifying necessary for running. It also has the power source for lighting the car for passenger service. In addition to this function as a power generator, it has a battery and motor-driven air compressor unit as well as an auxiliary power source and air source for the three-car unit.

(2) Motor car

Control equipment such as the main controller to regulate train speed, the line breaker, main resister, etc. are installed in the motor car.

(3) ATS equipment

Types of ATS equipment installed on rolling stock are cab-coils on motor cars and receivers on trailers.

(4) Coupling between units

Motor cars have tight-lock type automatic couplers to couple units. The coupler is controllable by a switch in the cab to facilitate operation.

2-2 Main specifications of Electric Railcars

The main specifications of electric railcars are shown in Table 2.2.1.

Table 2.2.1 Main Specifications

Kind of rolling stock	All metal, control electric motor car (Mc) and trailer (R)
Car type	M4000 (Control electric motor car), R4600 (trailer) suburban commuter type
Train formation	Mc-R-Mc fixed three-car unit (maximum three units)
Track gauge	1676 mm
Electric system	Single phase, AC 25 kV, 50 Hz, overhead contact wire system
Tare weight	Mc = 51t, R = 51t
Seating capacity	Mc = 64 persons, R = 68, [maximum = 200 (15t)]
Rolling stock dimensions	L = 24500, W = 3136, H = 3880 mm (R H = 4525 mm with pantograph folded)
Floor height	1275 mm
Entrance	H = 1900, W = 1350 mm
Distance between bogie centers	17500 mm
Rolling stock performance	Maximum speed = 120km/h Acceleration = 2.88km/h/s (up to 50km/h with load of 15t)

	Deceleration: Service braking = 2.88 km/h/s Emergency braking = 3.60 km/h/s
Safety device	Intermittent control, memory-type ATS device and deadman control
Coupler	CSD-90 tight-lock coupler (in front) CSE-55 rod-type coupler (in the middle)
Bogies:	Steelplate/swing bolster with coil spring, swing bolster shoe, and pedestal wear plate
Type	(Mc) bogie ND-116, (R) bogie ND-116T
Rigid wheel base	(Mc) bogie 2700 mm, (R) bogie 2500 mm
Wheel diameter	910 mm
Traction motors:	Self-ventilated, ripple current series motor with interpole
Type	SE-629
Rating (one hour)	Output/V/A/rpm: 230 kW /600 V /420 A /1860 rpm (field control - 90%)
Rating (continuous)	Output/V/A/rpm: 220 kW /600 V /400 A /1900 rpm (field control - 90%)
Driving gear	Parallel cardan driving, with single-reduction gear and flexible gear coupling (WN drive) Gear ratio: 86:20 = 4.3

Current collection device	PT-58-A pantograph Rise: by air, descent: by coil spring
Auxiliary motor-driven air compressor	MH99-AK18A type Motor: DC 80 V, 400 W, 10 minutes rating Compressor: 80.8 1/min. 1700 rpm
Emergency ground switch device	CA 701-A
Vacuum circuit breaker	KCB - 106R Rated voltage/current/rupturing capacity: 27.2 kV /200 A /100 MVA
Lightning arrester	RVLMB - 38.5Y
Main transformer:	Shell type transformer with oil pump, air cooling by fan
Type	FPWR type
Capacity	Primary/secondary/tertiary: 2020/1980/40 kVA
Voltage	Primary/secondary/tertiary: 25000/556-3U×2G/247 V
Current	Primary/secondary/tertiary: 80.8/594/162 A
Main rectifier:	2-group, 3-bridge cascade connection, forced air cooling system
Output	960 kW x 2G, 1200 V, 800 A
Control equipment:	Load-compensating rheostatic brake, motor-driven cam shaft system
Control system	Thyristor phase control
Type	Main controller MM54-A Line breaker PH-90-4J
Control circuit	DC 100 /AC 200 V, 5 kg/cm^2

Main smoothing reactor	Forced air cooling system Continuous rating: 720A 7mH
Brake equipment	CS-1 automatic electromagnetic brake equipment, with load compensating control device for air and electric brake
Motor driven air compressor unit	Single-phase induction motor drive, horizontal and contrapositioned, 4-cylinder type, C2020-HB 2000 D type Motor: 11.5 kW /240 VAC /68 A /940 rpm Compressor: 1996 ℓ/min. 940 rpm
Motor alternator	CLG-610 single phase induction motor drive and 2-phase, 3-wire type alternator Induction motor: 17 kW /240 V /94 A /1500 rpm Rotating field type alternator: 15 kVA /220 V /34 A /1500 rpm
Door operating equipment	DP-40-DS electromagnetic valve, double sliding door, single acting, direct-connecting type
Ventilation equipment	Passenger room: Single phase AC 220 V, 50 Hz motor, axial blower system $24m^3$/min. × 8 sets - (Mc) $24m^3$/min. × 7 sets - (R) Driver's cab: Single phase AC 220 V 50 Hz electric fan, $18m^3$/min × 1
Lighting	Ceiling light: AC 220 V, 40 W fluorescent lamp × 22 - (Mc), 20 - (R) Room (stand) light: DC 100 V, 15 W incandescent lamp × 3 Driver's cab lamp: DC 100 V, 20 W incandescent lamp × 2 Destination display device: AC 220 V, 20 W fluorescent lamp × 1

Headlight and marker lights	Headlight: DC 100 V, 150 W/50 W Sealed-beam × 2 Position light: DC 100 V, 20 W incandescent lamp × 4 Taillight: DC 100 V, 20 W incandescent lamp × 2 Side pilot lamp: DC 100 V, 15 W incandescent lamp × 2 - each car
Heating device	Driver's cab: 500 W × 1
Battery	Alkaline battery: AMM40P-77F, rating 92.4 V, 40 AH/5 hour ratio × 1

2-3 On-board Equipment and its Arrangement

On-board equipment and its arrangement are shown in Fig. 2.3.1 - Fig. 2.3.9

Fig. 2.3.1 Equipment Arrangement on the Roof (R)

Fig. 2.3.2 Equipment Arrangement Inside and Attached to the Car-body (Mc)

Fig. 2.3.3 Equipment Arrangement Inside and Attached to the Car-body (R)

Fig. 2.3.4 Equipment Arrangement in the Driver's Cab (Mc)

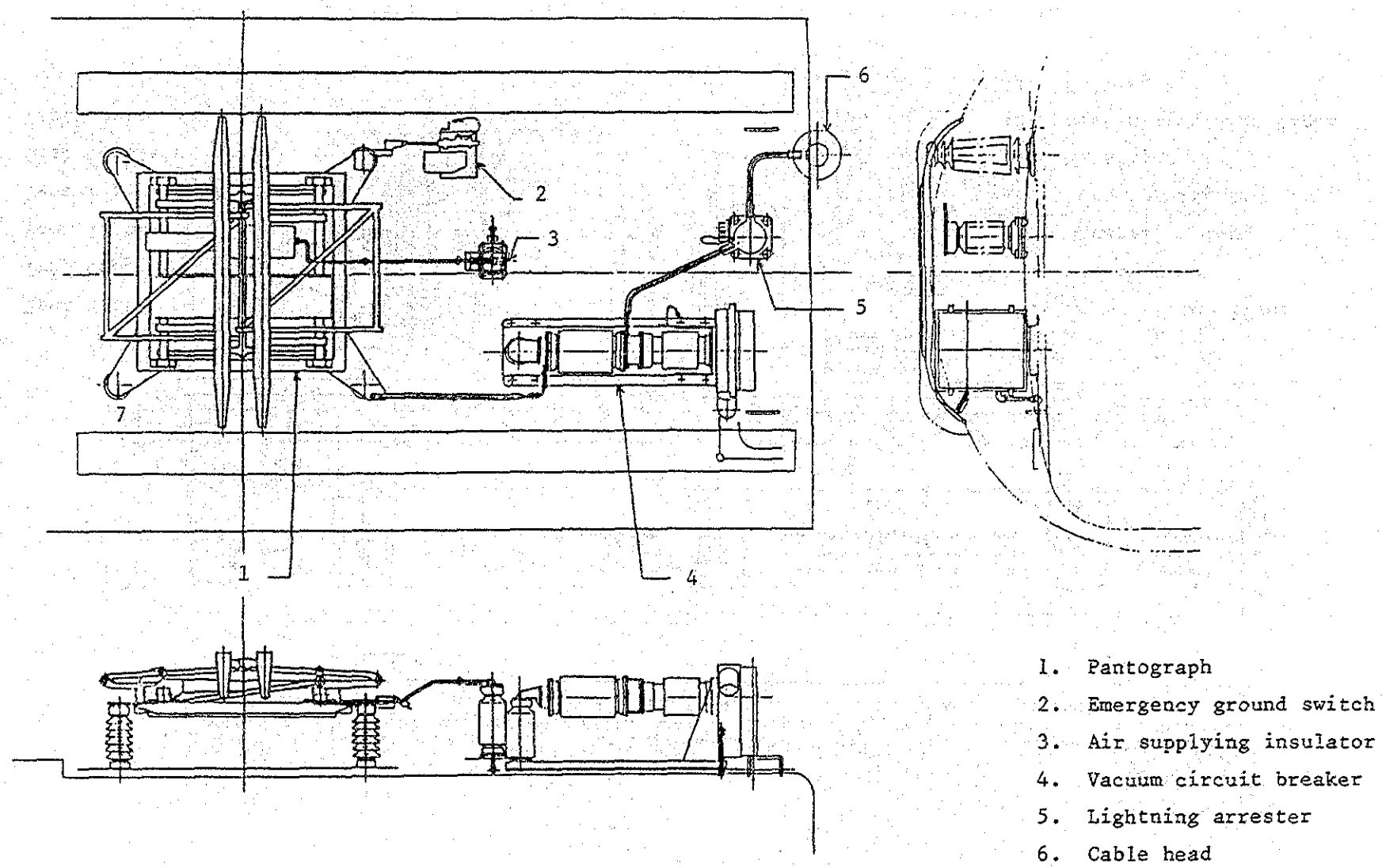
Fig. 2.3.5 Equipment Arrangement on the Bogie (Mc)

Fig. 2.3.6 Equipment Arrangement on the Bogie (R)

Fig. 2.3.7 Equipment Arrangement under the Floor (Mc)

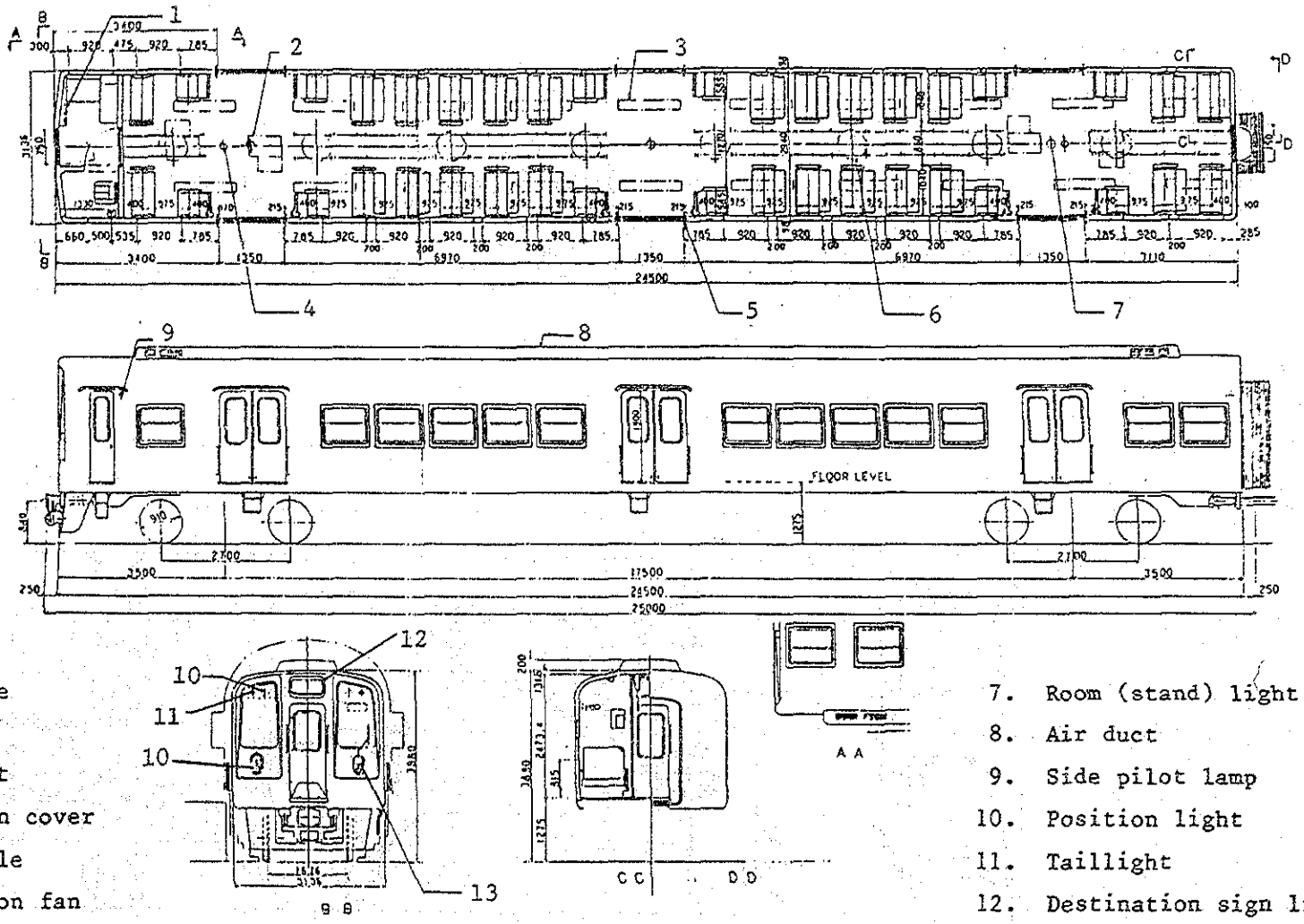
Fig. 2.3.8 Equipment Arrangement under the Floor (R)

Fig. 2.3.9 Equipment Arrangement Related to ATS Equipment (Mc, R)



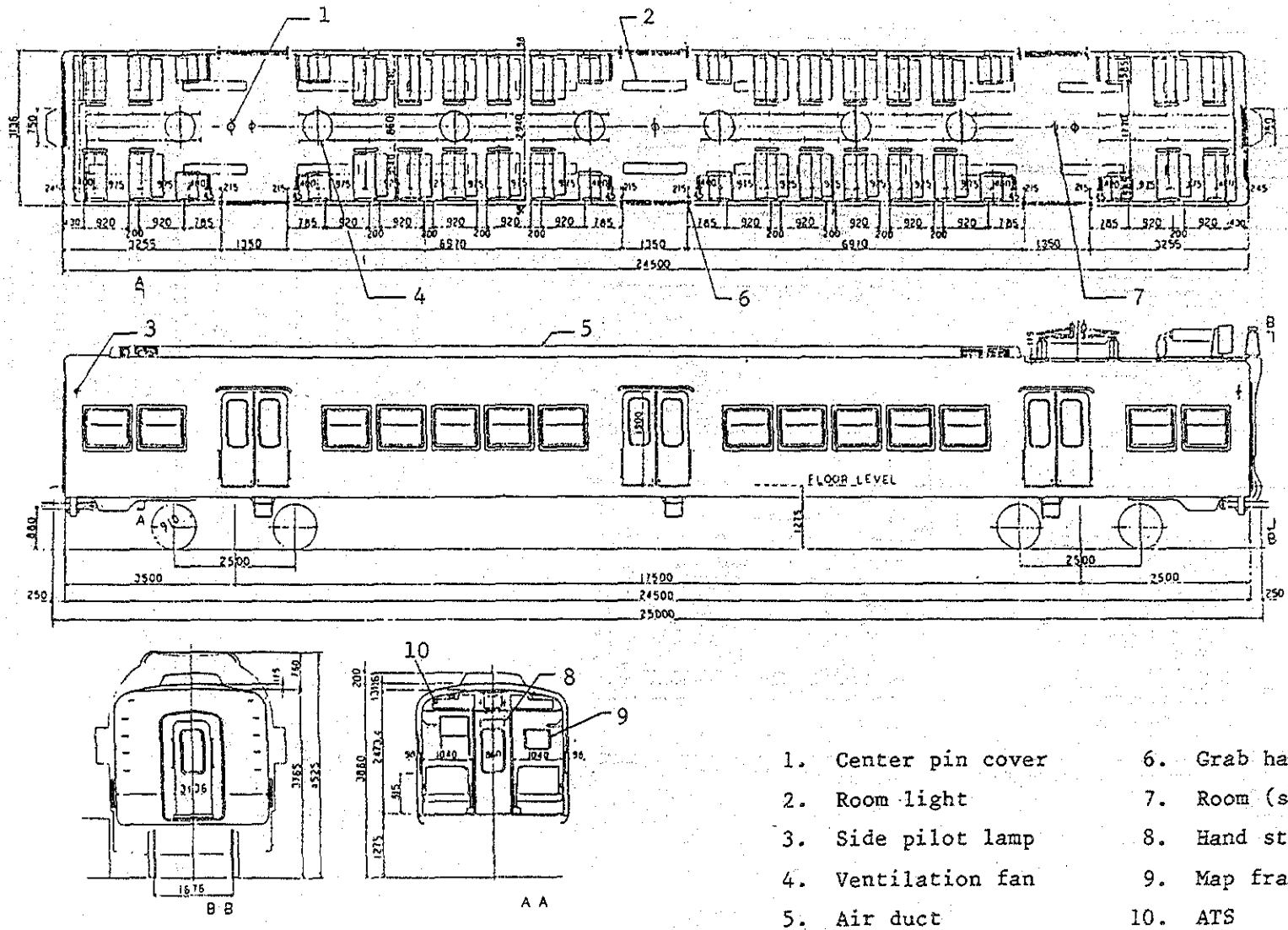
1. Pantograph
2. Emergency ground switch
3. Air supplying insulator
4. Vacuum circuit breaker
5. Lightning arrester
6. Cable head
7. Pantograph insulator

Fig. 2.3.1 Equipment Arrangement on the Roof (R)



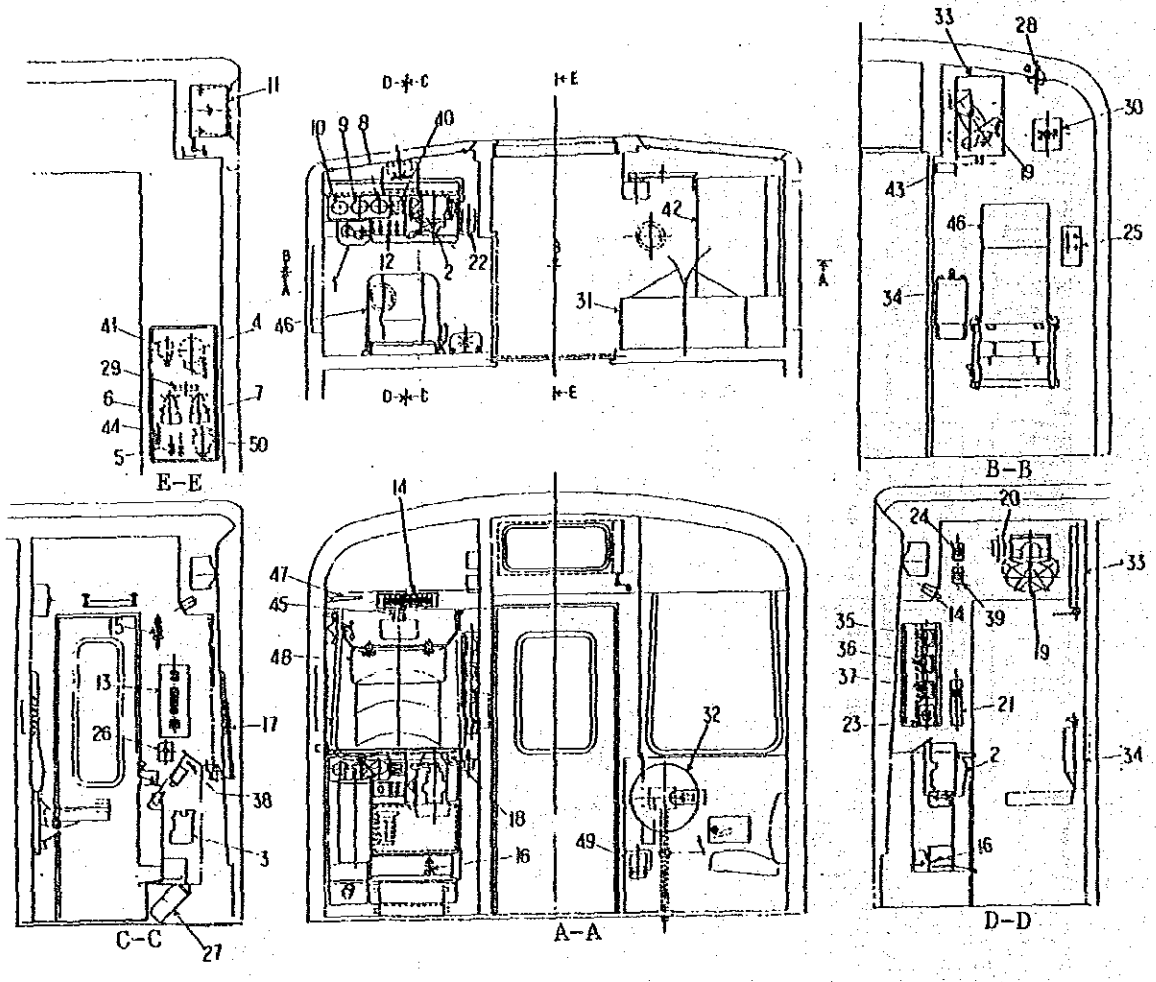
1. Hand brake
2. Trap door
3. Room light
4. Center pin cover
5. Grab handle
6. Ventilation fan
7. Room (stand) light
8. Air duct
9. Side pilot lamp
10. Position light
11. Taillight
12. Destination sign light
13. Headlight

Fig. 2.3.2 Equipment Arrangement Inside and Attached to the Car-body (Mc)



1. Center pin cover
2. Room light
3. Side pilot lamp
4. Ventilation fan
5. Air duct
6. Grab handle
7. Room (stand) light
8. Hand strap
9. Map frame
10. ATS

Fig. 2.3.3 Equipment Arrangement Inside and Attached to the Car-body (R)



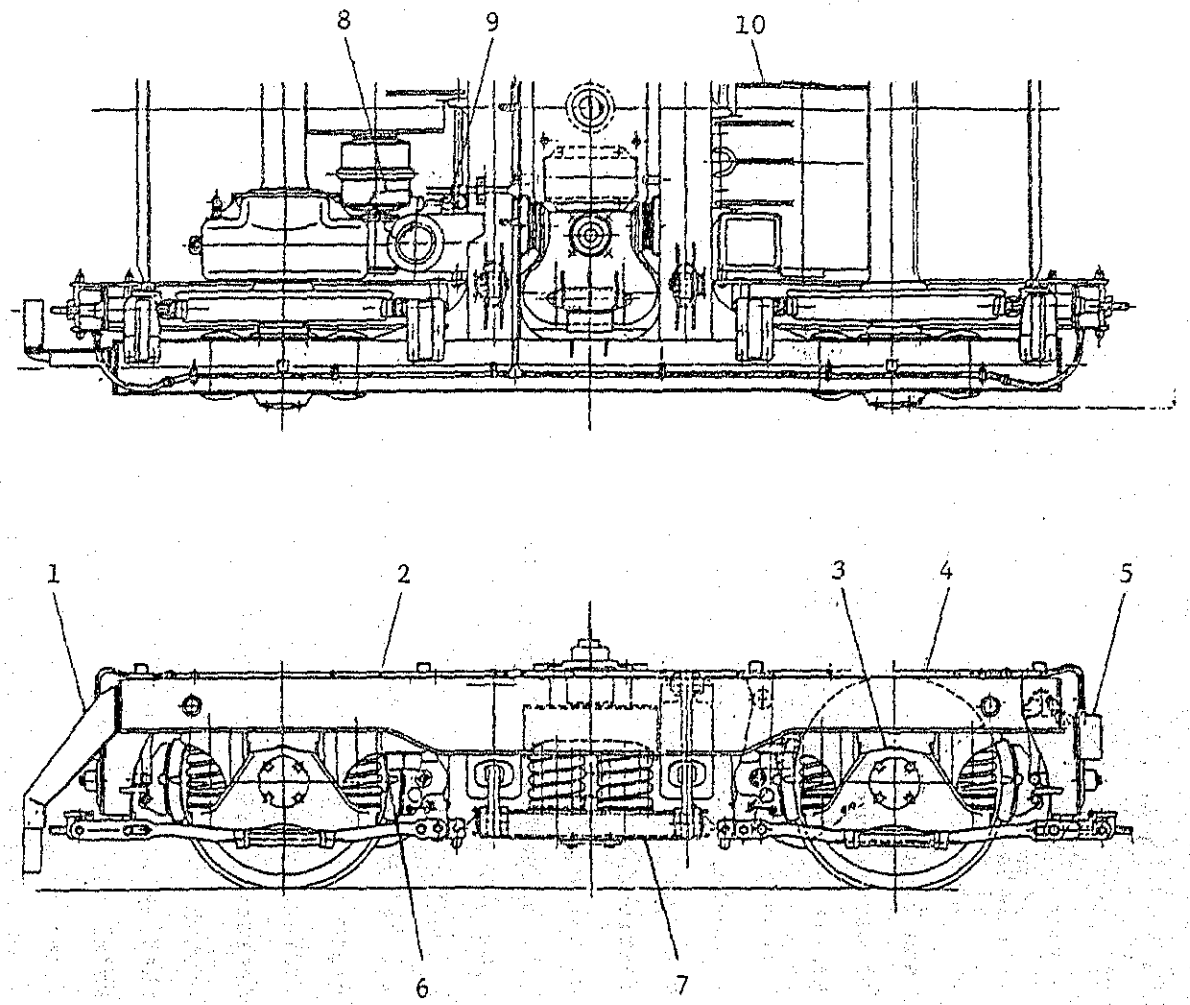
1. Master controller
2. Brake valve
3. Brake application valve
4. Interface unit
5. Cutout cock
6. Magnet valve for ATS service brake
7. Magnet valve for ATS emergency brake
8. Speedometer
9. Pressure gauge (MR/ER)
10. Pressure gauge (BP/BC)
11. Destination display device
12. Driver's desk switch panel (5 points)
13. Switch box (8 points)
14. Pilot lamp (10 points)
15. Emergency brake valve
16. Whistle valve

(cont'd)

Fig. 2.3.4 Equipment Arrangement in the Driver's Cab (Mc)

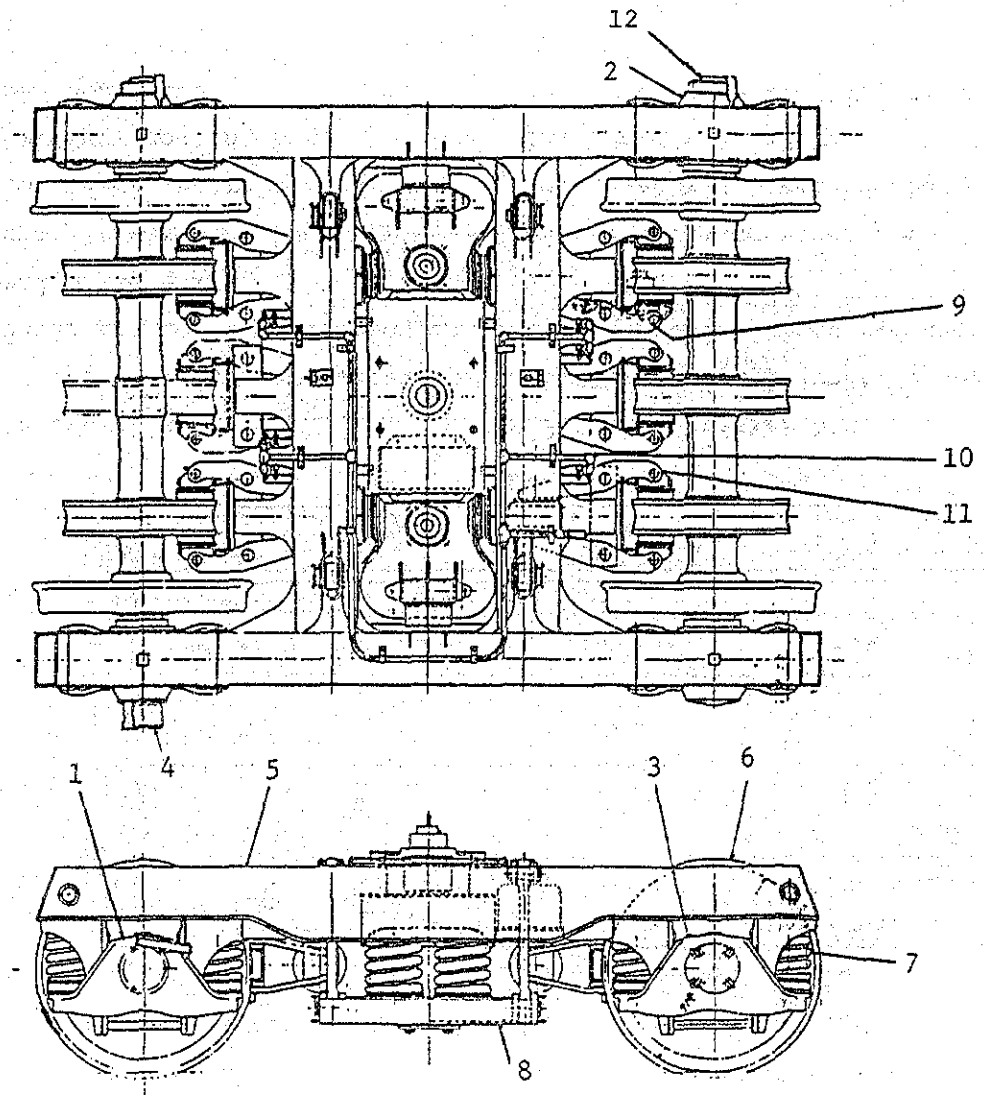
Driver's Cab (cont'd)

17. Wiper
18. Wiper pilot valve
19. Electric fan
20. Junction box
21. ATS indicator lamp/reset switch
22. ATS change-over switch
23. Emergency ground switch
24 Emergency buzzer
25. Door control switch for conductor
26. Buzzer switch for signal
27. Electric heater
28. Driver's cab lamp
29. Terminal board
30. Switch box (3 points)
31. Switchboard box
32. Hand brake
33. Forward/reverse change-over switch
34. Electric tight coupler cutout operating switch
35. Catenary voltmeter
36. Voltmeter for battery circuit
37. Sequence test voltmeter
38. Instrument lamp
39. Signal buzzer
40. Door operating/fault pilot lamp
41. Pressure switch
42. Driver's seat
43. Wiring hole cover (train radio power)
44. Alarm whistle
45. Train number-plate hanger
46. Assistant driver's seat
47. Luggage net
48. Shading plate
49. Pedal for destination display device operation
50. Transfer valve



1. Life guard
2. Bogie frame
3. Axle box
4. Wheel and axle
5. Tread-friction type brake equipment
6. Axle spring
7. Swing bolster
8. Variable load valve
9. Piping for brake gear
10. Traction motor

Fig. 2.3.5 Equipment Arrangment on the Bogie (Mc)



1. Axle box (for tacho-generator)
2. Axle box (for earth device)
3. Axle box (for general use)
4. Tachometer generator
5. Bogie frame
6. Wheel and axle
7. Axle spring
8. Swing bolster
9. Variable load valve
10. Piping for brake gear
11. Disk friction type brake equipment
12. Earth brush device

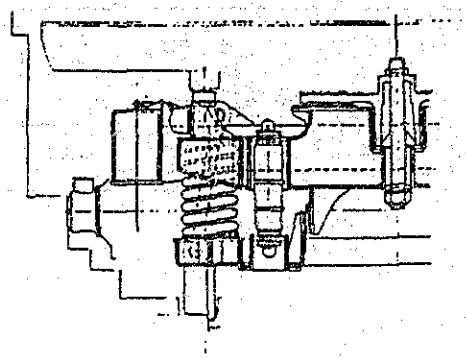
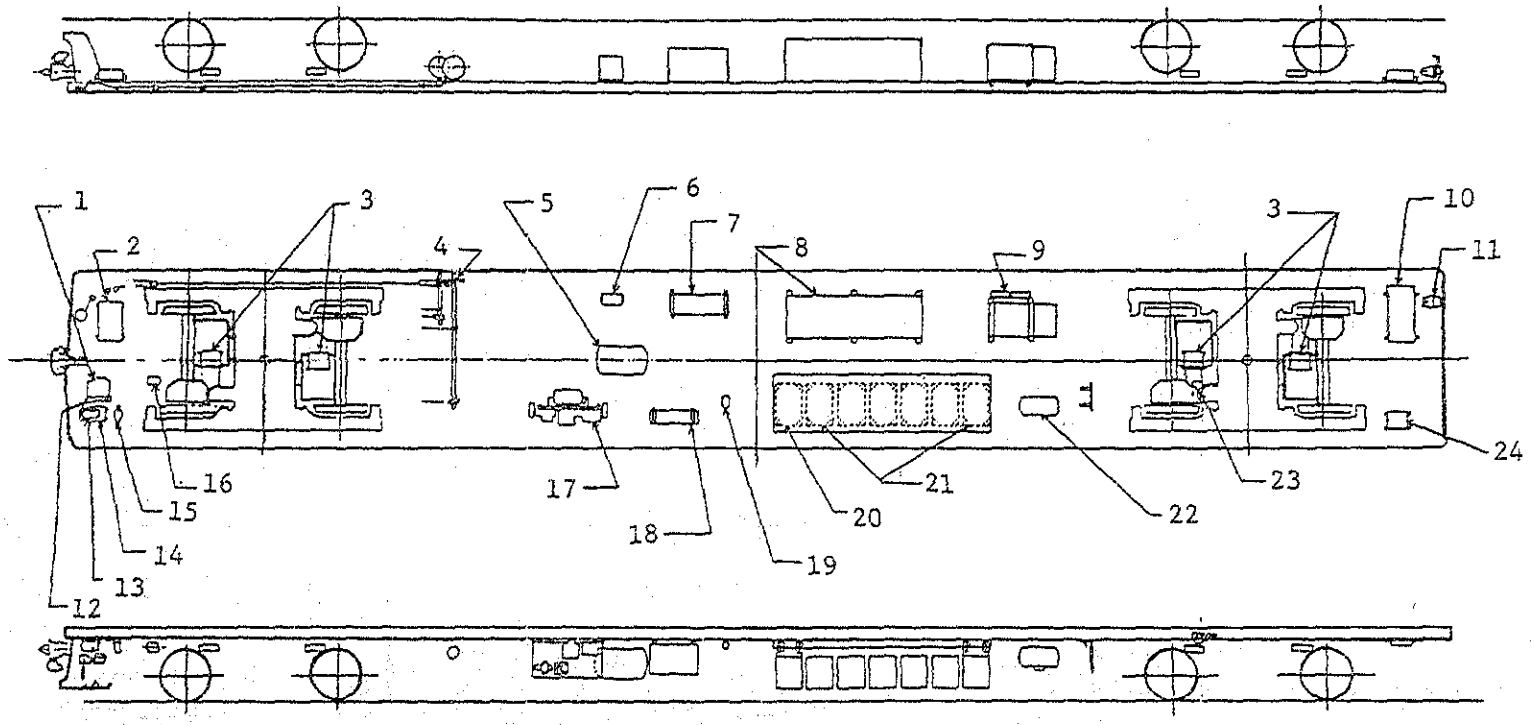
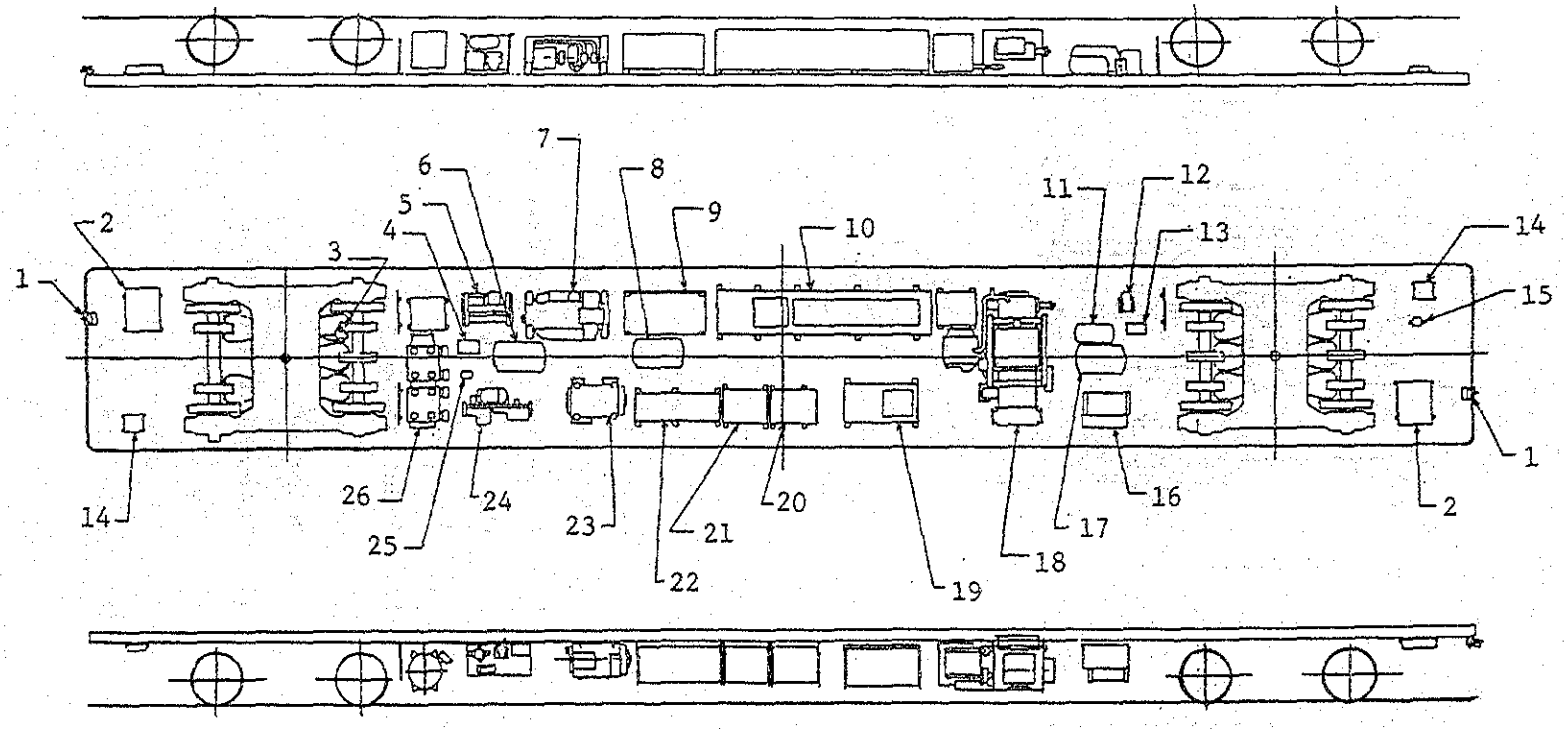


Fig. 2.3.6 Equipment Arrangment on the Bogie (R)



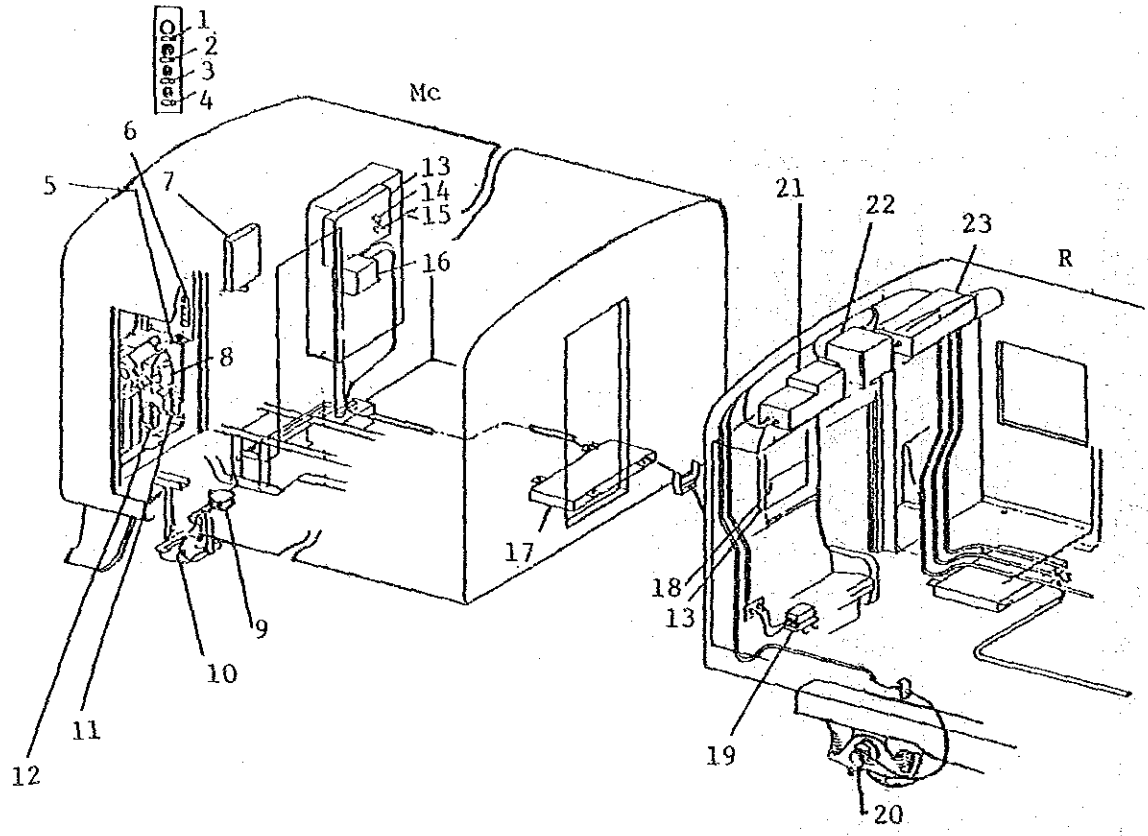
1. ATS cab coil
2. Junction box for car operation
3. Connection box for traction motor
4. Hand brake gear
5. Supply reservoir
6. Door operating relay box
7. Auxiliary control box
8. Main controller
9. Line breaker box
10. Low voltage junction box
11. Electric jumper receptor
12. AW-5 whistle
13. Equalizing reservoir
14. Electric tight coupler cutout device
15. No.8 vent valve
16. Reduction limiting reservoir
17. Brake operating unit
18. Actuator and pressure switch box
19. Volumetric reservoir
20. Field shunting resistor
21. Main resistor
22. Control reservoir
23. Load detector valve
24. High voltage junction box

Fig. 2.3.7 Equipment Arrangment under the Floor (Mc)



1. Jumper coupler dummy recepter
2. Low voltage junction box
3. Load detector valve
4. Condenser box
5. Air dryer
6. Supply reservoir
7. Motor-driven air compressor unit
8. No.1 main reservoir
9. Battery box
10. Main rectifier
11. Control reservoir
12. Current transformer
13. Door operating relay box
14. High voltage junction box
15. No.8 vent valve
16. Auxiliary air control equipment
17. No.2 main reservoir
18. Main transformer
19. Protection resistor box
20. VCB relay box
21. Auxiliary control box
22. Motor alternator control device
23. Motor alternator
24. Brake operating unit
25. Volumetric reservoir
26. Main smoothing reactor

Fig. 2.3.8 Equipment Arrangment under the Floor (R)



1. ATS reset switch
2. Indicator lamp for ATS brake operation
3. Indicator lamp for ATS operation
4. Indicator lamp for shunting
5. ATS change-over switch
6. Indicator lamp for ATS cutout
7. Forward/reverse change-over switch
8. Brake valve
9. Cab coil connection box
10. ATS cab coil
11. Electromagnetic valve for ATS service brake
12. Electromagnetic valve for ATS emergency brake
13. Distributing board
14. ATS power breaker switch
15. ATS cutout switch
16. Pre-receiver
17. Junction box
18. ATS breaker switch
19. Recorder
20. Tachometer generator
21. ATS receiver
22. ATS supervisor
23. ATS relay box

Fig. 2.3.9 Equipment Arrangement Related to ATS Equipment (Mc, R)

2-4 Ideas for Future Electric Railcars

The following equipment found on electric railcars in Japan can be thought of for installation newly or additionally in future electric railcars in Argentina:

(1) Public address system (for passenger information)
(2) Train radio
(3) Electric heater
(4) Air-conditioning unit
(5) Power source and controller for (3) and (4)

CHAPTER 3 WORKSHOP PLAN IN CONFORMITY WITH THE 1ST STEP ELECTRIFICATION

CHAPTER 3 WORKSHOP PLAN IN CONFORMITY WITH THE 1ST STEP ELECTRIFICATION

3-1 Inspection/Repairing System for Electric Railcars of the General Roca Line

The inspection/repairing system is based on the principle of preventive maintenance and the contents are shown in Table 3.1.1.

Table 3.1.1 Inspection/Repairing System for Electric Railcars of the General Roca Line

	Type of Inspection	Inspection Periodicity	Inspection Facilities	Contents of Inspection
Periodical Inspection	Daily inspection	≦3,000 km or ≦48 hours	Depot	1. Function inspection of a car 2. Inspection and renewal of parts
	Monthly inspection	≦18,000 km or ≦30 days	Depot	Function inspection of main equipment
	Intermediary inspection	≦400,000 km or ≦24 months	Workshop	Demounting and inspection/repairing of main equipment
	Overall inspection	≦800,000 km or ≦48 months	Workshop	Overhaul inspection/repairing
Unperiodical Inspection	Temporary inspection	As needed	Depot or Workshop	Inspection/repairing as need arises

Periodical inspections are subject to a "demounting standard." The standard shows the details of the scope of demounting, disassembling, and inspection. Table 3.1.2 shows demounting standard for main equipment in the Overall and Intermediary Inspections carried out in the workshop. The demounting standard for each piece of equipment is shown in the Appendix 4.

Table 3.1.2 Demounting Standard for Main Equipment

Equipment	Demounting Classification	
	Overall Inspection	Intermediary Inspection
Pantograph	Demount and disassemble	Partly demount and disassemble
VCB	Demount and disassemble	Demount and disassemble
Lightning arrester	Demount and inspect	Inspect as installed
Main transformer	Inspect as installed	Inspect as installed
Main rectifier	Partly demount and inspect	Partly demount and inspect
Main smoothing reactor	Demount and disassemble	Inspect as installed
Line breaker	Partly demount and disassemble	Partly demount and disassemble
Traction motor	Demount and disassemble	Demount and disassemble
Main controller	Partly demount and disassemble	Inspect as installed

Equipment	Demounting Classification	
	Overall Inspection	Intermediary Inspection
Main resistor	Demount and disassemble	Inspect as installed
Motor alternator	Demount and disassemble	Partly demount and disassemble
Auxiliary control box	Partly demount and inspect	Inspect as installed
Battery	Demount and inspect	Demount and inspect
Junction box	Inspect as installed	Inspect as installed
ATS on-board equipment	Demount and inspect	Partly demount and inspect
Master Controller	Demount and disassemble	Inspect as installed
Speedometer	Demount and disassemble	Demount and disassemble
Voltmeter	Demount and disassemble	Demount and disassemble
Car-body	Inspect as installed	Inspect as installed
Coupler device	Partly demount and disassemble	Partly demount and disassemble
Running gear	Demount and disassemble	Demount and disassemble
Foundation brake equipment	Demount and inspect	Demount and inspect
Air brake equipment	Demount and disassemble	Demount and disassemble
Door operating equipment	Partly demount and disassemble	Inspect as installed
Auxiliary air control equipment	Partly demount and disassemble	Partly demount and disassemble

3-2 Location of Workshop

The Argentine Railways has decided to construct an inspection/repairing workshop for AC electric railcars of the General Roca Line on its land, 10 km from Plaza Constitución. The workshop is called the "KM 10 Workshop". The Argentine Railways is making preparations for this. The land area is 267,600m^2 and the configuration is shown in Fig. 3.2.1.

The rolling stock depot is already situated at Llavallol.

3-3 Number of Rolling Stock Assigned

The KM 10 Workshop will be in charge of Overall Inspection, Intermediary Inspection, and some Temporary Inspection of AC electric railcars, 52 units/156 cars for the 1st Step electrification. The Llavallol Depot is in charge of Monthly Inspection, Daily Inspection, and some Temporary Inspection.

3-4 Number of Rolling Stock Inspected Annually

The average daily running-km at the opening stage of the 1st Step section, as planned by the Argentine Railways, is to be 400 ∿ 500 km. Under this operating condition, Overall and Intermediary Inspections will be carried out at periodic intervals but not on the basis of train-km.

The number of rolling stock to be inspected annually at the workshop will therefore be:

Overall Inspection:	13 units/39 cars
Intermediary Inspection:	13 units/39 cars

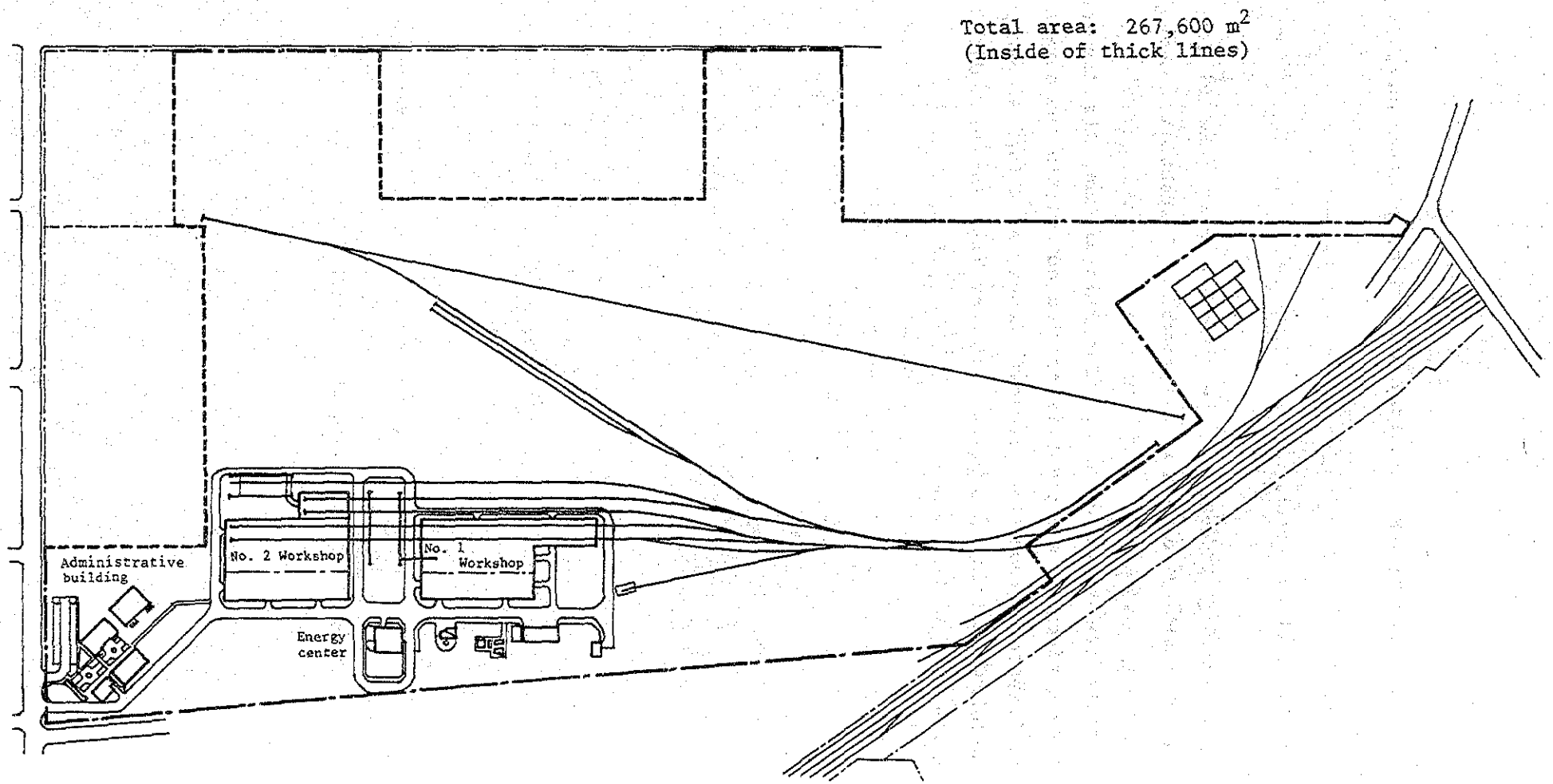


Fig. 3.2.1 KM 10 Workshop

The number of cars undergoing Temporary Inspection at the workshop will be about 16 cars.

3-5 Inspection/Repairing Process

The inspection/repairing process at the workshop will take 19 days for Overall Inspection and 14 days for Intermediary Inspection. Among the inspection/repairing processes, the car-body inspection/repairing process is generally the critical path. For this reason, the inspection/repairing of each piece of equipment is carried out within the duration of this car-body inspection/repairing process. Hence, as a typical example of various inspection/repairing processes, the car-body inspection/repairing process is given in Fig. 3.5.1.

Number of Days for Inspection	Overall Inspeciton		Intermediary Inspection	
1	Entrance inspection Car-body lifting		Entrance inspection Car-body lifting	
2	Demounting		Demounting	
3				
4				
5	Car-body repair	Inspection /repairing of all other equipments	Car-body repair	Inspection /repairing of all other equipments
6				
7				
8				
9	Car-body painting		Mounting	
10				
11			Car-body lowering	
12			Leaving inspection	
13	Mounting		Running test in the workshop	
14			Running test on the main line	
15				
16	Car-body lowering			
17	Leaving inspection			
18	Running test in the workshop			
19	Running test on the main line			

Fig. 3.5.1 Car-body Inspection/Repairing Process

3-6 Workshop Layout

The KM 10 Workshop will have a land area of 267,600 m^2, a building area of 15,339 m^2, and track length of 3,760 m. The plan of the workshop is composed of No. 1 Workshop, No. 2 Workshop, Energy Center, Incidental Buildings and Administrative Building (see Fig. 3.2.1). No. 1 Workshop and No. 2 Workshop are located on each side of the traverser situated in the center. Their relative positions are shown in Fig. 3.6.1.

The No. 1 Workshop consists of an entrance/leavig inspection shop, a demounting/mounting shop, a bogie shop, a wheel and axle shop, and a traction motor shop. The No.2 Workshop consists of a car-body shop, a car-body painting shop, an air brake equipment shop, an electric equipment shop, a pipe works shop, an ironwork shop, a machine shop, a car-body equipment shop, a spare parts storage area, and others.

The building area of the No. 1 Workshop will be 5,760 m^2, that of the No. 2 Workshop 6,120 m^2, that of Energy Center 450 m^2, that of Incidental Buildings 734 m^2 and that of Administrative Building 2,275 m^2.

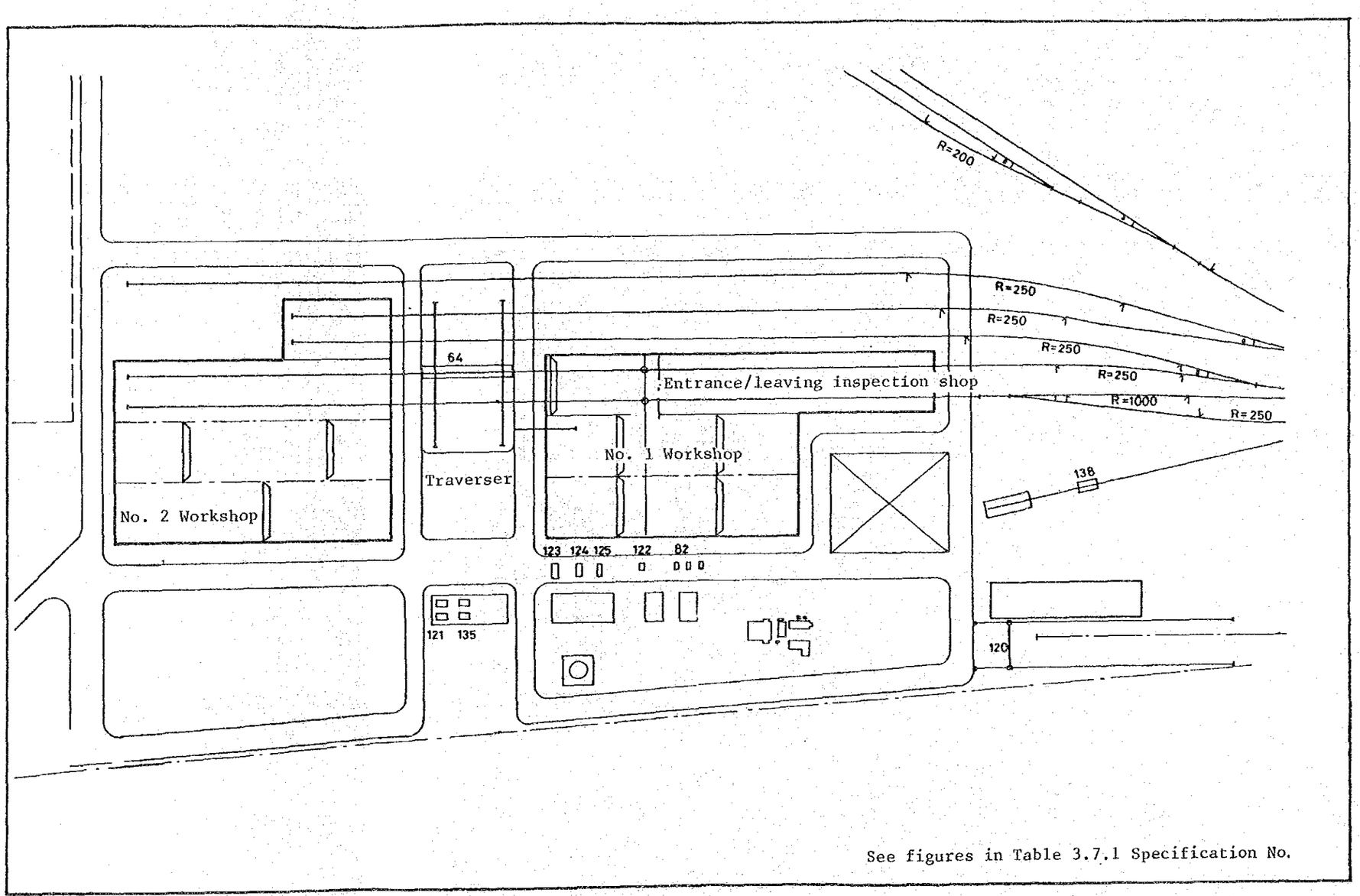
The arrangement of various shops and machines of the No. 1 and No. 2 workshops is shown in Figs. 3.6.2 and 3.6.3. The area of each shop is shown in Table 3.6.1.

The inspection work process is as follows.

(1) After being airblasted outdoors, the three-car unit is pushed into the entrance/leaving inspection shop by a shunting locomotive and receives an entrance inspection.

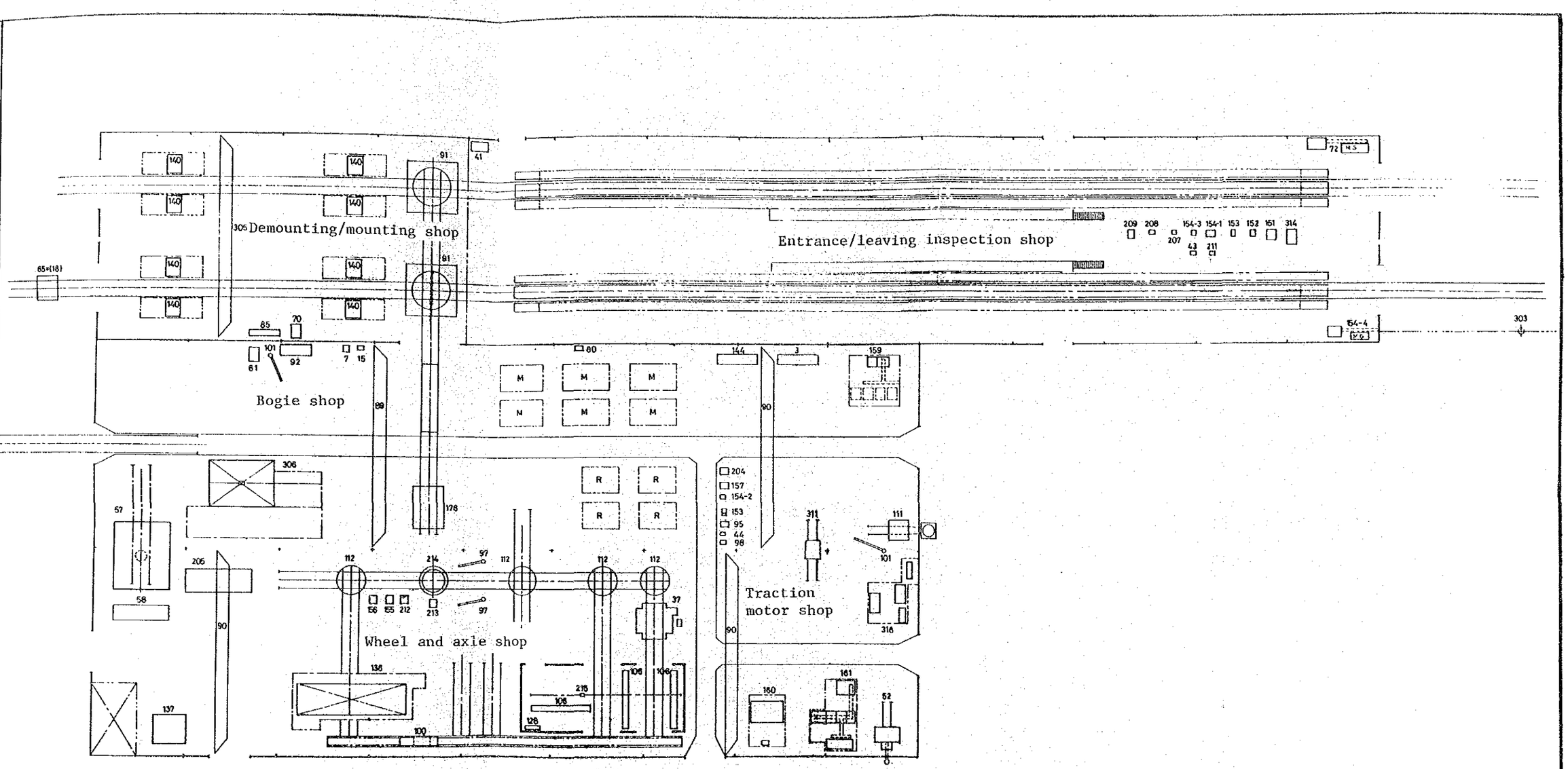
(2) The unit is uncoupled and each car is pushed into the demounting/mounting shop. The pantograph, VCB and other equipment on the roof, the coupler, and auxiliary rotating equipment are demounted.

(3) Each car body is lifted up by jacks, bogies are demounted, and the car body is reset on temporary bogies.



See figures in Table 3.7.1 Specification No.

Fig. 3.6.1 The Plan of the Workshop



See figures in Table 3.7.1 Specification No.

Fig. 3.6.2 The No. 1 Workshop - Arrangement of Various Shops and Machines

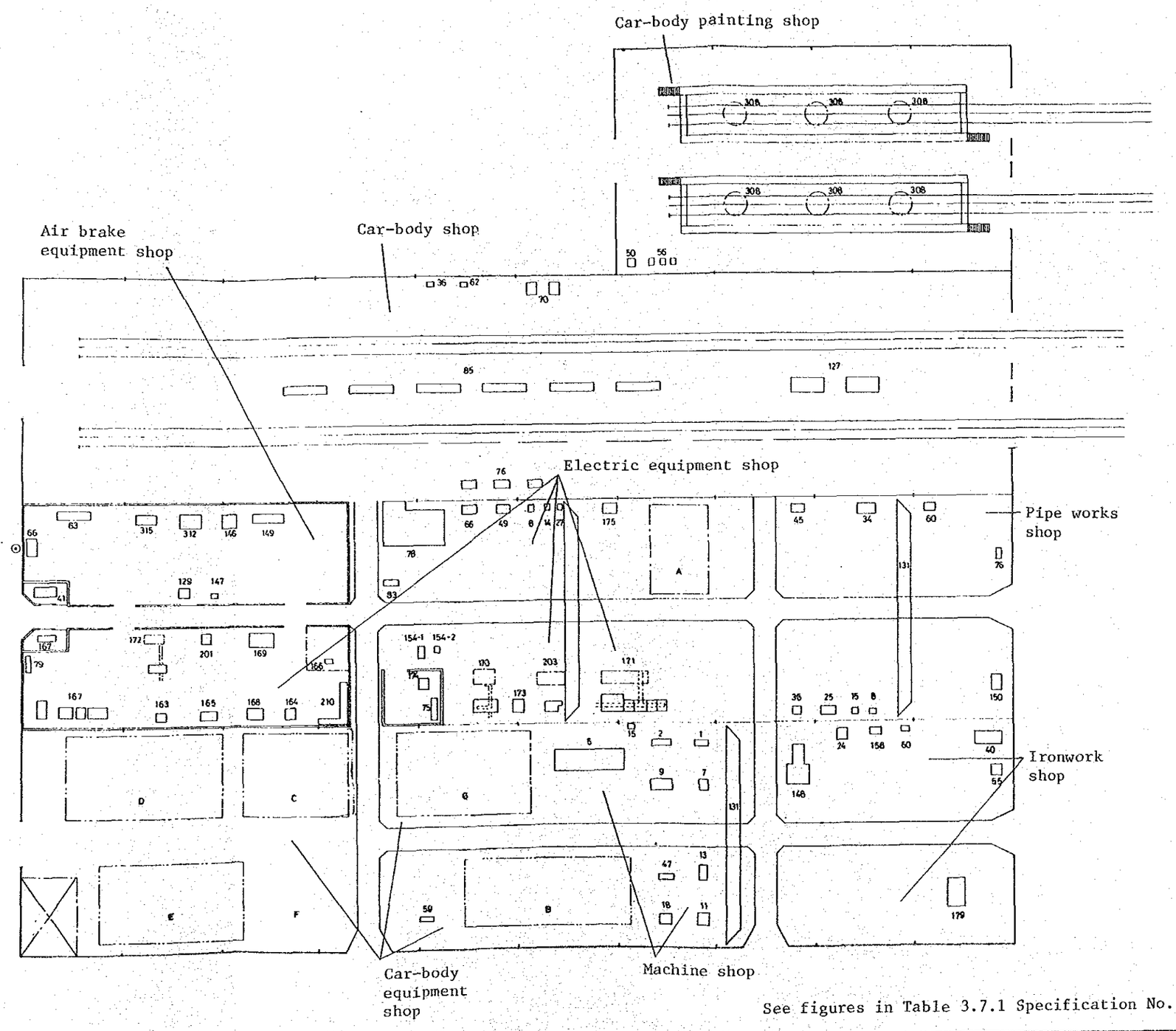


Fig. 3.6.3 The No. 2 Workshop - Arrangement of Various Shops and Machines

Table 3.6.1 Area of Each Shop

Workshop	Shop	Area (m^2)	Notes
The No. 1 Workshop	Entrance/leaving inspection shop	1,800	3 cars 2 tracks
	Demounting/mounting shop	720	1 car 2 tracks
	Bogie shop	1,425	
	Wheel and axle shop	1,135	
	Traction motor shop	600	
	Others	80	Office, lavatory
	Total	5,760	
The No. 2 Workshop	Car-body paint shop	720	1 car 2 tracks
	Car-body shop	1,760	3 cars 2 tracks
	Pipe works shop	230	
	Electric equipment shop	1,030	Car-body equipment 270
	Air brake equipment shop	310	
	Ironwork shop	690	Seat and vestibule diaphragm 360
	Machine shop	360	
	Car-body equipment shop	940	Spare parts storage space 310
	Others	80	Office, lavatory
	Total	6,120	
Energy center		450	
Incidental buildings		734	Garage, dangerous items storage etc.
Administrative building		2,275	Office, dressing room, dining room, etc.
Grand Total		15,339	

(4) Bogies are sent to the bogie shop using a turntable. Wheels and axles and traction motors are demounted. Bogie frames, wheels and axles, and traction motors are inspected and repaired on their respective process lines. After inspection/repairing work is completed, these components are reassembled.

(5) The car-body on temporary bogies is transferred to the car-body shop by the traverser.

(6) At the car-body shop, air brake equipment, electric equipment, and car body equipment are demounted and moved to their respective shops for inspection/repairing work.

(7) After demounting various pieces of equipment, the car-body is inspected and repaired.

(8) In the case of an Overall Inspection, the car-body is sent to the car-body painting shop and painted after car-body repair.

(9) Various pieces of finished equipment are mounted again in the car-body shop.

(10) The car-body is sent back by traverser to the demounting/mounting shop. There, the car body is lifted up, temporary bogies are removed, and finished bogies are mounted. On-the-roof equipment, auxiliary rotating equipment, etc. are also mounted.

(11) After all equipment is mounted, the car is pulled out to the entrance/leaving inspection shop. Then, the leaving inspection and running test in the workshop and running test on the main line are conducted. These will complete the workshop inspection/repairing work.

3-7 Inspection/Repairing Machines

Inspection/repairing machines to be installed at each shop are shown in Table 3.7.1. Their arrangements at each shop are shown in Figs. 3.6.1, 3.6.2 and 3.6.3.

Table 3.7.1 Inspection/Repairing Machines

Specification No.	Machinery	Quantity
1 - Entrance/leaving inspection shop		
72	Power source device for testing	1
314	Air brake tester	1
151	Electric car wiring tester	1
152	Vehicle borne A.T.S. device tester	1
153	Insulation resistance tester	1
154-1	Dielectric strength tester	1
154-3	Dielectric strength tester	1
154-4	Dielectric strength tester	1
207	Electric car performance tester	1
208	Running record analyser	1
209	Main rectifier tester	1
211	Main controller tester	1
41	Air compressor	1
43	Vacuum cleaner	1
303	Underfloor equipment air blast equipment	1
2 - Demounting/mounting shop		
65	Temporary bogie	18
70	Underfloor equipment demounting/mounting equipment	1
85	Scaffolding for car-body repair	1
91	Bogie turn table	1
140	Lifting jack	8
305	Overhead travelling crane, 2 ton	1
3 - Bogie shop		
7	Upright drilling machine	1
15	Pedestal grinding machine	1
57	Bogie painting equipment	1
60	Electric welder	1
61	Spring tester	1

Specification No.	Machinery	Quantity
89	Overhead travelling crane, 15 ton	1
92	Magnetic flaw detector	1
101	Jib crane, 1/4 ton	2
176	Bogie disassembling equipment	1
306	Bogie washing equipment	1
	4 - Wheel and axle shop	
37	Oilflushing equipment	1
58	Hydraulic wheel press	1
97	Jib crane, 1/4 ton	2
100	Wheel and axle traverser	1
106	Roller conveyer	1
112	Turntable	4
128	Air conditioning equipment	1
136	Wheel lathe	1
137	Vertical lathe	1
155	Magnetic flaw detector	1
156	Ultrasonic flaw detector	1
205	Brake disc lathe	1
212	Axle bearing removing machine	1
213	Bearing cleaning equipment (Movable)	1
215	Monorail crane, 1/2 ton	1
90	Overhead travelling crane, 5 ton	1
214	Turntable with wheel and axle rotating equipment	1
	5 - Traction motor shop	
3	Lathe	1
44	Demagnetizer	1
52	Drying furnace	1
95	Pinion heater	1
111	Air blast booth	1
90	Overhead travelling crane, 5 ton	2
144	Dynamic balancing machine	1
153	Insulation resistance tester	1
154-2	Dielectric strength tester	1

Specification No.	Machinery	Quantity
157	Insulation deterioration tester	1
159	Traction motor tester	1
160	Motor ventilator tester	1
161	Motor alternator tester	1
316	Air compressor tester	1
204	Layer short-circuiting tester	1
311	Traverser for rotating machine	1
98	Axle bearing induction heater	1
	6,7 - Car-body shop and car-body painting shop	
36	Electric welder	1
50	Paint mixer	1
56	Car-body painting machine	3
62	Hydraulic pressure tester	1
70	Underfloor equipment, demounting/mounting equipment	2
76	Cart	3
85	Scaffolding for car-body repair (Movable)	6
127	Tractor	2
308	Air exhaust	6
313	Scaffolding for car-body painting	4
	8 - Electric equipment shop	
8	Bench drilling machine	1
14	Bench grinding machine	1
27	Buffing machine	1
49	Soft grit blasting machine	1
66	Dust arresting equipment	1
131	Overhead traveling crane, 2 ton	1
75	Water purifying equipment	1
78	Washing equipment	1
79	Air conditioning equipment	1
83	Low platform cart	1

Specification No.	Machinery	Quantity
154-1	Dielectric strength tester	1
154-2	Dielectric strength tester	1
163	Speedometer generator tester	1
164	Electric meter calibrating apparatus	1
165	Electro-magnetic valve tester	1
166	Lightning arrester tester	1
167	A.T.S. tester	1
168	Distributing circuit breaker tester	1
169	Relay tester	1
170	M.A. control equipment tester	1
171	Main control rectifier tester	1
172	Vacuum circuit breaker tester	1
173	Power source device for testing	1
174	Battery capacity tester	1
175	Electric power source device for testing	1
201	Contactless relay tester	1
203	Main controller tester	1
210	Various electric measuring apparatuses	1
	9 - Machine shop	
1	Lathe (650)	1
2	Lathe (1000)	1
7	Upright drilling machine	1
9	Radial drilling machine	1
11	Universal milling machine	1
13	Shaper	1
15	Pedestal grinding machine	1
18	Universal tool grinding machine	1
47	Hacksawing machine	1
5	Axle lathe	1

Specification No.	Machinery	Quantity
	10 - Pipe works shop	
34	Pipe bender	1
45	Threading machine	1
60	Electric welder	1
76	Cart	1
131	Overhead travelling crane, 2 ton	1
	11 - Air brake equipment shop	
41	Air compressor	1
63	Ultrasonic washing equipment	1
66	Dust arresting equipment	1
129	Wiper tester	1
315	Air brake valve tester	1
146	Safety valve tester	1
147	Pressure gauge tester	1
149	Door engine tester	1
312	Brake valve tester	1
	12 - Iron work shop	
15	Floor stand type grinding machine	1
24	Hydraulic press, 100 ton	1
25	Shearing machine, 6 mm	1
38	Spot welder	1
40	Pneumatic power hammer, 1/4 ton	1
55	Furnace	1
60	Electric welder	1
131	Overhead travelling crane, 2 ton	1
148	Tight-lock coupler tester	1
150	Oil damper tester	1
158	Magnetic flaw detector	1
179	Draft gear disassembling/assembling machine	1
	13 - Car-body equipment shop	
59	Industrial sewing machine	1

Specification No.	Machinery	Quantity
	14 - Energy center	
121	Boiler	2
135	Air commpressor	2
	15 - Shunting locomotive shed and garage	
82	Fork lift truck, 1.5 ton	3
122	Fork lift truck, 2 ton	1
123	Motor truck, 6 ton	1
124	Motor truck, 0.5 ton	1
125	Fire engine	1
138	Shunting locomotive	1
	16 - Others	
120	Gantry crane, 5 ton	1
64	Traverser	1

3-8 Building, Track, Catenary, and Other Facilities

3-8-1 Buildings

Buildings of the KM 10 Workshop consist of the No. 1 Workshop, the No. 2 Workshop, the energy center, incidental buildings, and administrative building, and these are mainly constructed of steel frames and reinforced concrete.

3-8-2 Tracks and Catenaries

Trauks in the workshop are the entrance/leaving track, the running test track, stabling track, etc., and 50 kg/m rails are used for these tracks. As for catenaries, the entrance/leaving track is installed with a direct suspension trolley system and the running test track is installed with a simple catenary system.

3-8-3 Various Facilities

(1) Electric facilities
Electric power sources of 13.2 kV are supplied from Temperley Substation for normal use and from Plaza Constitución Substation for emergency use.

(2) Signal facilities
A shunting signal at Escalada Yard is used for entrance/leaving train operation.

(3) Communication facilities
Telephones, a yard public address system, and clocks are installed.

(4) Effluent treatment facilities
Subject to the sewage standard, oil and paint mist are treated.

(5) Natural gas facilities
City gas is supplied.

(6) Water supply facilities

City water is supplied.

3-9 Man-hours for Inspection/Repairing Work and the Number of Employees

Man-hours for each inspection are:

Overall Inspection	2,400 man-hours
Intermediary Inspection	1,500 man-hours
Temporary Inspection	250 man-hours

Based on the number of cars inspected and repaired annually and man-hours for each type of inspection work, the number of employees planned initially is 141 persons and they are classified as follows:

Direct workers	105
Indirect workers	11
Foremen	10
Management staff	15

CHAPTER 4 TOTAL NUMBER OF ELECTRIC RAILCARS NEEDED FOR THE 2ND STEP ELECTRIFICATION

CHAPTER 4 TOTAL NUMBER OF ELECTRIC RAILCARS NEEDED FOR THE 2ND STEP ELECTRIFICATION

Demand forecasting is carried out in this chapter to estimate the railway passenger flow at the beginning of 2nd Step electrification commercial operation and thereafter. Based on the results, a transportation plan is drawn up and the total number of railcars needed is calculated.

At this time, however, it has not yet been decided when electrification work or electrified service will begin on 2nd Step sections. Therefore, demand forecasting and related studies are being carried out targeted at A.D. 2000 taking into account economic, social, and other conditions of Argentina.

4-1 Traffic Demand Forecasting

4-1-1 Basic Concept

Demand forecasting in this study is carried out fundamentally by a "four step estimate method" (Fig. 4.1.1). In this method, preparatory work is done estimating the socioeconomic frame values, such as on the future population, which are thought to govern traffic demand. In the first step, trip generation/attraction by zone is estimated based on the socioeconomic frame values obtained in the preparatory work.

In making this estimation, the current trip generation/attraction rate is obtained from the present number of trip generation/attraction and the present socioeconomic frame and is applied to future estimations.

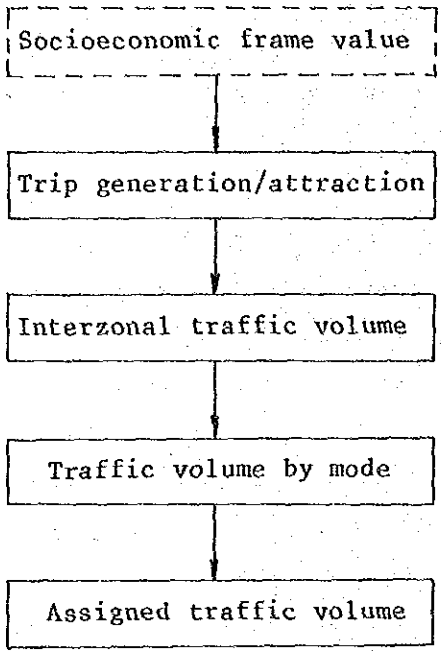


Fig. 4.1.1 The General Flow of the Four-Step Estimate Method

In the second step, the interzonal traffic volume is estimated. This is estimated by linking the trip generation and trip attraction by zone as obtained in the first step based on the current Origin-Destination (OD) table. The gravity model and the present pattern method can be considered as forecasting models. Which of these is applied differs according to the population distribution pattern, the amount of traffic facilities available, and other factors.

In the third step, traffic volume by mode, in particular railway traffic volume, is estimated using a modal split curve model based on the interzonal traffic volume obtained in the second step. Time, cost, and the like can be thought of as the primary factors which explain the modal split curve.

In the fourth step, the interzonal railway traffic volume is distributed over the railway network using the minimum path distribution method.

4-1-2 Preconditions

(1) Target year of forecast

The target year of the forecast will be, in principle, A.D. 2000.

(2) Zoning

For demand forecasting, it is necessary to grasp required planning information with the zone as a unit by dividing regions into zones. This work is called zoning.

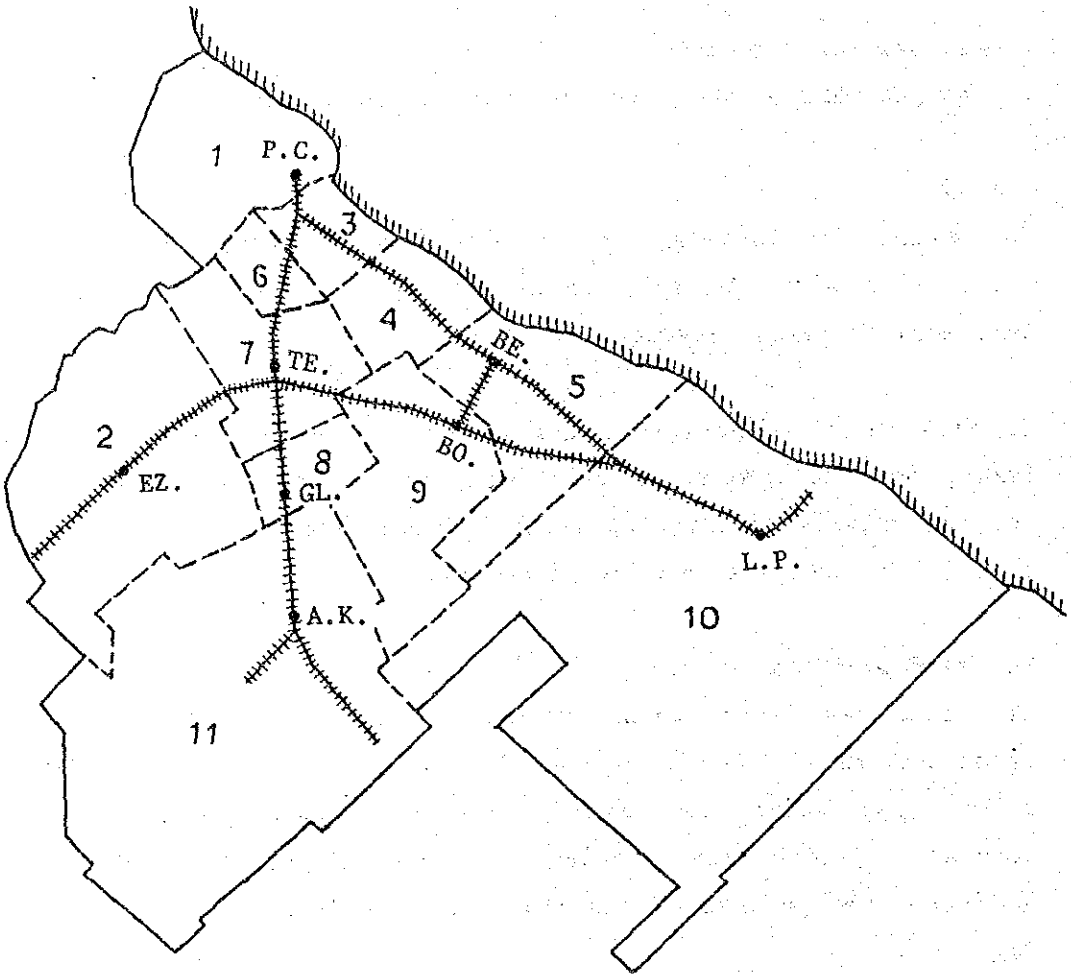
In this study, the regions are divided by administrative boundaries, taking into consideration existing plans, studies and their outcomes, and the relative difficulty of collecting data, resulting in 11 zones. Fig. 4.1.2 shows the results of zoning.

(3) Future population by zone

The actual population values by region for 1970 and 1980 were tabulated according to the zones defined in Fig. 4.1.2. Based on this, the future population for each zone is estimated using the future population growth rate. Estimated values are shown in Table 4.1.1. In addition, the population distributions for 1980 and 2000 are shown in Fig. 4.1.3.

(4) OD table

In order to forecast demand, the current livelihood of the residents and condition of transportation modes in the target area must be grasped and analyzed. One indispensable piece of information for this is the current OD table.



Remarks

No.	Name of Zone	No.	Name of Zone
1	Capital Federal	7	Lomas de Zamora
2	Esteban Echeverria	8	Almirante Brown
3	Avellaneda	9	Florencio Varela
4	Quilmes	10	La Plata*
5	Berazategui	11	San Vicente
6	Lanús		

*Including Berrisso and Ensenada

Fig. 4.1.2 Zoning

Table 4.1.1 Estimate of Population by Zone

Unit: 1,000 persons

Year / Zone No.	1960	1970	1980	1990	2000
1	2,966.6	2,972.5	2,922.8	2,995.0	3,001.0
2	69.7	107.0	188.9	333.4	588.5
3	326.5	337.6	334.1	345.5	357.2
4	317.8*	355.0	446.6	561.8	706.7
5	-	125.4	201.9	325.1	523.4
6	375.4	449.8	467.0	484.7	503.1
7	272.1	607.0	788.1	1,023.0	1,327.9
8	136.9	41.7	53.9	69.7	90.1
9	41.7	92.5	173.5	325.2	610.6
10	404.1	485.9	560.3	646.0	744.8
11	25.6	39.2	55.8	79.4	113.0

* Including population of Berazategui.

Figures after 1990 are estimates.

Source: Censo Nacional de Población y Vivienda 1980

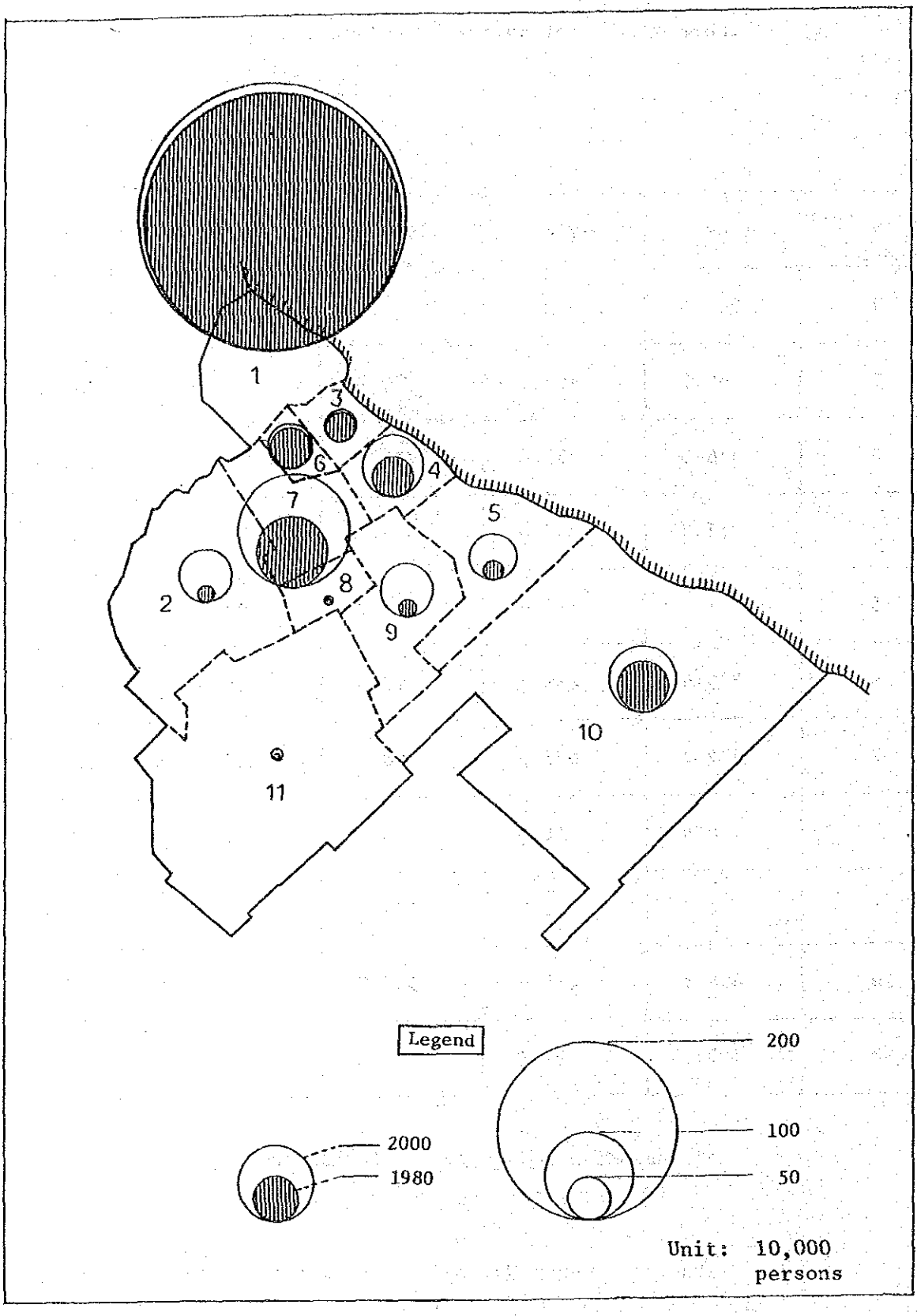


Fig. 4.1.3 Distribution of Population

It was not possible to obtain such recent data for this study. It is possible, however, to construct an OD table at least for railways on the basis of the number of tickets sold, but this would be of limited credibility. Thus, data was used from "Estudio Preliminar del Transporte de la Región Metropolitana" (Ministerio de Obras y Servicios Públicos, 1972), (hereafter referred to as EPTRM).