3.08 Doors and Mechanism

(a) Doors and door mechanism shall be in accordance with door option No. 1, No. 2 or No. 3 hereinbelow as selected by the Company and specified in Section 6.09(14)(a). Any special requirements as to doors not covered hereinbelow shall also be specified in Section 6.09(14)(g).

DOOR OPTION NO. 1 - Power operated metal doors, with top and bottom support, curved to match the body contour, shall be mounted as shown on T.R.C. Drawing No. 3-8a1.

DOOR OPTION NO. 2 - Power operated metal doors with overhead support only, curved to match the body contour, shall be mounted as shown on T.R.C. Drawing No. 3-8a2.

DOOR OPTION NO. 3 - Power operated flat doors shall be mounted to fold as specified in Section 6.09(14)(b) at both front and center door openings. When option No. 3 is specified in Section 6.09(14)(a) details of door design and mounting will be supplied by Company.

(b) Each passageway at door openings shall be equipped with door leaves arranged to operate in accordance with the option selected.

(c) All leaves of all doors of option No. 1 shall be as shown on T.R.C. Drawing No. 3-8c1 and all doors of option No. 2 as shown on T.R.C. Drawing No. 3-8c2.

(d) The door leaves shall be equipped with hollow, molded or formed rubber seals on both vertical edges as shown on T.R.C. Drawing No. 3-8c1 for option No. 1 and T.R.C. Drawing No. 3-8c2 for option No. 2. These shall be so arranged that the seals on abutting edges shall be at least 2" deep and shall be designed so as to house sensitive edges when so specified in Section 6.09(14)(c). The seals shall provide adequate weather tightness when the doors are in the closed position. The upper ends of all abutting rubber door edges shall be stiffened with sponge rubber inserts approximately 2" in length.

(e) When door option No. 1 or No. 2 is specified, a molded rubber seal of right angle shape shall be attached to the door jambs at each side of passageway to seal tightly against the rubber edges of the doors when in the closed position. Rubber seals for the upper ends of the door leaves also shall be fitted above the door openings. These seals shall be sufficiently elastic to permit all door leaves to close tightly against them.

(f) Doors shall be glazed as specified in Section 2.05, using non-hardening putty.

3.08 Doors and Mechanism (Cont'd)

(g) When door option No. 1 or No. 2 is specified, grab handles shown on T.R.C. Drawing Nos. 3-8c1 or 3-8c2 shall be provided on the inside of the front door leaf of each passageway. These shall be made of stainless steel meeting the specifications given in Section 2.02(d).

(h) Door operating mechanisms shall be arranged to operate two door leaves per passageway and shall hold the doors firmly in the closed and open positions respectively. The mounting shall prevent rattling of the doors when in any position.

(i) The door operating mechanisms shall consist of electric motors and transmissions as specified in Section 6.09(14)(d) connected to operating linkages of approved type and design. Provision shall be made for adjustment of position, cushioning and speed of operation as specified in Section 6.09(14)(e), and for later take-up in places where significant wear may be expected, and these provisions shall be arranged to permit adequate locking after adjustment.

(j) The motors and door operating shafts shall be mounted on a common steel bed plate and shall be so arranged that the motors and connecting mechanism are housed in cabinets above the doors. Overhead cabinets shall be arranged to provide at least 6', 7" clearance over the tread of the lowest step, and the bottom surface of the cabinet shall not project into the car more than 6" from a vertical plane tangent to the nosing of that step. Ample provision, as by means of a hinged door, shall be made for lubrication and maintenance of the door operating mechanism and this door and its fastenings shall be arranged to prevent vibration and noise when the car is in operation. The doors of the motor cabinets shall be designed with approved grilles or screens open to the car interior, and shall be equipped with convenient means for holding them open when desired. The interiors of these cabinets shall be properly painted.

(k) Unless otherwise specified in Section 6.09(14)(g), the front doors shall be controlled from the operator's position with provision for selective or simultaneous operation.

(l) When treadle operation is specified in Section 6.09(14)(f), the center doors shall be individually controlled by separate treadles operating on nominal 32 volts and equipped with contacts of non-corrosive material. Functioning of the treadles shall be under the control of the operator. There shall be provided electric interlocks with the motor control circuit which will prevent starting of the car before all center doors are substantially closed.

(m) The treadles shall be located on the lowest and the second steps; not on the car floor. The control of the treadles shall be arranged so that they cannot be operated readily from outside the car.

3.08 Doors and Mechanism (Cont'd)

(n) When specified in Section 6.09(14)(g), provision shall be made so that center doors can be opened from the outside of car by means of a suitable key.

(o) When specified in Section 6.09(14)(c), the center doors shall be provided with automatic reversing mechanism actuated by contact of the door edge with an obstruction, and arranged to reverse the motion of the doors except after the door edges have come within approximately 2" of the closed position. When closing of the doors is obstructed within approximately 2" of closed position, a bell alarm shall be sounded near the operator's seat.

(p) Provision shall be made for automatically balancing all doors in case of release or full depression of the foot interlock, and in case of emergency brake application.

(q) Provision shall be made to prevent draining of the battery through the door control circuits when the car is out of service.

(r) The arrangement of rails, stanchions and barriers associated with doors and stepwells shall be such as to minimize the danger of a passenger being struck by the inner edge of an opening door leaf.

3.09 Stanchions, Rails and Barriers

(a) Stanchion and hand rail arrangement shall be as shown on the Company's drawing indicated in Section 6.09(15)(a). Unless otherwise specified in Section 6.09(15)(b) stanchions shall consist of 1-1/4" O.D. stainless steel veneered tubing with satin finish, Allegheny architectural tubing, or approved equal. The stainless steel shall conform to specifications given in Section 2.02(d). It shall have a thickness of not less than 0.026". The insert shall be made of soft steel and shall have a wall thickness of 0.049".

(b) Stanchions shall be clamped or otherwise securely held top and bottom in fittings of chromium plated brass or stainless steel as specified in Section 6.09(15)(c). Fittings which are to be painted need not be chromium plated. All fittings shall provide a permanently tight and rattle-proof fastening.

(c) Hand rails, except those on the seat backs and at the operator's position as specified below, shall be of the same size and material as the stanchions.

(d) Fittings on hand rails shall be made of chromium plated brass or stainless steel, as specified in Section 6.09(15)(c), with an approved form of screwed lock for joining stanchions, hand rails and fittings.

3.09 Stanchions, Rails and Barriers (Cont'd)

(e) Tubular steel rails as shown on T.R.C. Drawing No. 3-12r2, shall be attached to the operator's desk so as to afford convenient hand rests for the operator and a hand rail for passengers. This rail shall be covered with firmly attached Micarta, or approved equal tubing having an outside diameter of 1-1/4", with wall thickness at least 1/8".

(f) Stepwell barriers extending from the floor to approximately window sill elevation and projecting into the car approximately 21", shall be installed to the rear of the front stepwell and at both ends of the center stepwell.

(g) These barriers shall be made of metal, so shaped and mounted as to be free from vibration and noise. Exposed edges of metal shall be properly protected.

3.10 Heating and Ventilation

(a) A combined system for heating and ventilation of the car and for cooling the control resistors and ventilation of the traction motors, shall be installed as shown on T.R.C. Drawing No. 3-1c1. This system shall utilize the motor and brake control resistor heat for heating the car. When specified in Section 6.09(16)(a), there shall also be provided auxiliary heating elements having a capacity of 10 kilowatts (exclusive of vestibule heater) together with associated thermostat, switch, condenser and resistor, as provided hereinafter.

(b) Two 10" centrifugal type blowers, each rated as per characteristics shown on T.R.C. Drawing No. 3-10b1, shall be mounted with rotors directly assembled on extensions of the motor generator armature shaft. Each blower shall have a divided discharge outlet which shall be connected so that one outlet discharges into resistor compartment and the other outlet into a specially provided supplementary duct system leading to the traction motors. The blowers shall discharge 1000 c.f.m. toward the motors and 2000 c.f.m. into the resistor compartment. The blowers shall operate without objectionable noise at any car voltage up to 625. A small opening shall be provided between the resistor and the contactor compartments so that air pressure and a small flow of cooling air are maintained to keep this equipment cool and free of dust.

(c) The heating system shall be capable of maintaining automatically, in the car and at a height of 3' above car floor, a temperature of not less than 45° F. above outdoor temperature and with cross winds up to 30 m.p.h. It shall be so arranged as to avoid objectionable drafts of either hot or cold air.

(d) The required ducts and compartments of the combined heating and ventilating system shall constitute, as far as practicable, parts of the car structure or equipment housings. They

3.10 Heating and Ventilation (Cont'd)

(d) (Cont'd)

shall be arranged to provide easy access to heaters and wiring for inspection and maintenance and, to such extent as may be practicable, easy access for cleaning of air passages. They shall be air tight and dust tight. In places where removable covers are required they shall be provided with flexible seals capable of withstanding oil and the temperatures encountered. Hinges and latches shall be of sturdy construction and shall be attached by sturdy fastenings.

(e) Compartments and ducts which carry heated air shall be so designed and insulated as to prevent objectionable heat transmission to the car. Such insulation shall be flame resistant. The inside sheet of the longitudinal ventilating ducts near the floor shall be gasketed with suitable material to prevent squeaks. The entire system shall be so designed as to prevent the formation of objectionable hot spots on the car floor or on other parts of the car structure. It shall also meet the requirements with respect to forced draught central heating systems of the "N.F.P.A. Regulations for Electric Car and Trolley Buses".

(f) The heating and ventilating system blowers shall function to cool the control resistances at all times when the car is in operation. When, and to the extent that such air is not required for car heating, it shall be vented automatically to atmosphere by dampers appropriately located under the car, designed so they are "balanced" in the air stream which they control, and arranged so that the discharge to atmosphere is toward and near the blind side of the car, and is directed so as to avoid stirring up street dirt. These dampers shall be designed as unit assemblies and shall be so arranged and constructed as to prevent warm air from leaking into the car during the non-heating cycle. They may be linked together and have one operating device attached to either damper assembly and capable of operating both simultaneously.

(g) The driving unit of the blower shall be so interlocked with the traction motor control circuit that the car can not be operated unless the switch closing the circuit of the blower driving unit is closed.

(h) Whenever practical, the dampers for venting heated air to the atmosphere shall be so controlled as to open and dump automatically unless held in the closed position by action of a thermostatic element responding to car temperature. This thermostat shall be of the thermal modulating type for use with a progressive control, and shall be located so as to be responsive to temperature conditions that are representative of car body temperature. The setting of the car thermostat shall be as specified in Section 6.09(16)(b).

3.10 Heating and Ventilation (Cont'd)

(i) When specified in Section 6.09(17), the ventilation of the car shall be supplemented by overhead fans of approved type and make, having a total capacity of approximately 12,000 c.f.m. The fresh air supply for these fans shall be from a monitor, located on the roof of the car and extending the full length of the body as shown on T.R.C. Drawing No. 3-10il. The monitor shall be fitted with louvers or grilles and internal baffles to exclude rain and snow. Sections adjacent to the fans shall be for intake air, while sections intermediate thereto shall be for air which is exhausted from the car through the space between the headlining and the roof. The monitor shall be as low as practicable and designed so that it blends into the roof contour. The fans shall be automatically controlled by a thermostat located so as to be responsive to car temperature, and producing a minimum fan speed at 60°F and the maximum, or rated speed, at 95°F, with means for other adjustments.

(j) When auxiliary heaters are specified in Section 6.09(16)(a), one circuit breaker type switch shall be connected as an auxiliary heater switch and shall be arranged so that closing the switch energizes the operating coil of an auxiliary heater contactor. This shall be done by thermostatic control when specified in Section 6.09(16)(c). The setting of the auxiliary heater thermostat shall be as specified in Section 6.09(16)(c). The auxiliary heater contactor shall be in series with the motor generator set contactor so that the latter must be closed before the auxiliary heaters can be energized.

(k) A heater, the capacity of which is specified in Section 6.09(16)(f) shall be provided at the operator's position, and shall be controlled by an individual gang switch and independent of the thermostat. When specified in Section 6.09(16)(d), a 32 volt, 7" fan (maximum 37.5 volts) operating at approximately 2100 r.p.m. shall be mounted in position as specified by Company, to serve as a defrosting device.

(l) Unless specification of paragraph 3.10(i) is used, an intake ventilator of approved design shall be located on the car roof ahead of the trolley base and incorporated into the shroud thereof. It shall present architecturally an appearance of continuity of structure with the trolley base enclosure. The ventilator shall be designed to prevent rain and snow from entering the car duct system. It shall provide for the passage of air with a minimum pressure drop consistent with the above requirements. The ventilator shall admit air into the space between the roof and ceiling, and this area will act as a duct for distribution of air into the car through appropriate diffusers attached to the underside of the ceiling. The arrangement shall be such that entering fresh air is distributed evenly throughout the upper part of the car without objectionable drafts. Provision

3.10 Heating and Ventilation (Cont'd)

(l) (Cont'd)

shall be made to prevent condensation forming on the ceiling below the ventilator. A damper and its control shall be installed in the manner specified in Section 6.09(16)(e).

(m) Unless specification of paragraph 3.10(i) is used, two additional ventilators, one in the forward part of the car, and one back of the trolley base, shall be provided. The front ventilator shall admit air directly into the car through appropriate diffusers attached to the underside of the ceiling. The rear ventilator shall be installed to exhaust air.

3.11 Auxiliary Electrical Equipment

(a) *Installation of Wiring*

(1) All car wiring shall conform to the latest revision of the "N.F.P.A. Regulations for Electric Cars and Trolley Buses".

(2) All wire used shall be in accord with Section 2.08.

(3) Auxiliary wiring circuits shall be as shown diagrammatically on T.R.C. Drawing No. 3-11d4 and the installation shall conform to tabulations and notes thereon, unless otherwise specified in Section 6.09(18).

(4) The layout of wiring shall be designed in advance of its installation and in cooperation with those furnishing the connected equipment. Insofar as practicable, all wiring shall be fabricated on the bench into convenient units and installed in prefabricated groupings and standardized locations. Grounding connections shall be brazed and bolted or welded and bolted to the car body steel.

(5) When in metallic conduits, wiring which operates at trolley voltage shall be separated by suitable partitions from wiring which operates at battery voltage. Wires operating at these different voltages shall not be cabled together. When some parts of a given piece of electrical apparatus are to be connected to trolley voltage and other parts to battery, all wiring thereto shall be insulated for trolley voltage.

(b) *Motor Generator*

(1) A motor generator set shall be provided with each car. The car ventilating blowers as specified in Section 3.10(b) shall be connected directly to the shaft of this motor generator unit. The motor generator set and blowers shall each be dynamically balanced and shall be mounted on a common base, supported on rubber bushings as shown on

3.11 Auxiliary Electrical Equipment (Cont'd)

(b) (1) (Cont'd)

T.R.C. Drawing No. 3-11b1. The set, when operating under full load, shall have a nominal speed of 1750 r.p.m. at 550 volts, and shall be capable of safe and ample performance at any supply voltage between 450 and 650 volts. The motor generator set shall be arranged for ready removal and replacement through an opening in the skirt of the car on the blind side, or by being dropped vertically downward.

(2) Convenient accessibility for ordinary inspection, servicing and adjustment shall be provided through the opening in the skirt of the car. This opening shall be closed with a hinged door so arranged and fitted as to be weather tight when locked closed. There shall be a suitable flexible seal for this purpose, capable of withstanding oil and the temperatures encountered. The locking device shall be operable by the reverser handle to prevent opening by unauthorized persons.

(3) The lubricating holes of the motor generator set bearings shall be fitted with standard 1/8" pipe plugs to prevent unauthorized use of grease guns.

(4) The motor of the motor generator set shall have sufficient capacity to accomplish simultaneously the following several functions:

a. To drive the generator delivering all power required for controls and other auxiliary equipment, for magnetic track brakes, solenoid brake actuators, headlights, doors, sanders, windshield wipers and for charging the storage battery specified hereinafter, the total not to exceed the equivalent of 45 ampere continuous load.

b. To drive the 10" blowers specified in Section 3.10(b) at rated capacity.

(5) The generator of the motor generator set shall have sufficient capacity to charge the battery hereinafter specified and to maintain substantially constant voltage on the various auxiliary car circuits connected to the battery. The terminal voltage under operating conditions shall not exceed 37.5 volts, with any trolley voltage between 450 and 650 volts.

(6) The motor generator set shall either be self-regulating with respect to all functions or be equipped with voltage or current voltage regulating devices as necessary to enable it to perform all its functions properly and safely.

3.11 Auxiliary Electrical Equipment (Cont'd)

(c) *Storage Battery*

(1) A storage battery of approved type shall be supplied with each car. The battery shall be mounted in a compartment at the rear of the car or at other acceptable location and arranged for servicing and removal through doors. The battery compartment shall be gas tight with respect to the car interior and shall be properly vented to the outside atmosphere.

The arrangement shall provide a roller mounted tray which will permit the battery to be rolled out from the compartment for servicing. Adequate clamping bolts or other equivalent devices shall be provided.

(2) The battery shall be capable of use in conjunction with the motor generator set previously specified, as the source of power for controls and other auxiliary equipment, magnetic track brakes, solenoid brake actuators, headlights, door motors, sanders, windshield wipers, marker and signal lights, magnetic relays and other miscellaneous 32 volt equipment. The nominal voltage shall be 32 volts and the capacity at least 56 ampere hours at the 8 hour rate.

(3) Lead coated connectors and terminals shall be supplied with the battery for connection to car body leads.

(4) When specified in Section 6.09(19) a battery cut-out switch of approved design shall be provided and installed.

(d) *Control Desk*

(1) Control and auxiliary circuit switches to be handled by the operator, and all instruments and indicating lights, shall be mounted in an approved manner in front of the operator's position on a suitable control desk. This desk shall provide space for storage of transfers and for handling change, and all switches and instruments shall be labeled in an easily readable and permanent manner.

(2) The switches shall be grouped in three assemblies as shown on T.R.C. Drawing No. 3-11d2. These shall be so located as to afford convenient operation and shall be built into the operator's desk in such manner that all live parts are completely enclosed. The gang switch panels shall be horizontally hinged so that the switch groups may be turned outward to expose the terminals and wires of all individual switches for convenient inspection and maintenance. The upper surface of the operator's desk shall be provided with a durable dull finish to prevent reflection of sunlight, street lights or car lights into the operator's eyes.

3.11 Auxiliary Electrical Equipment (Cont'd)

(d) (Cont'd)

(3) All 600 volt switches shall be equipped with magnetic blow-out and shall be isolated from the 32 volt section by adequate barrier walls of insulating material.

(4) A voltmeter shall be mounted in an appropriate non-magnetic housing located in front of the operator and on the right hand side of the operator's desk and arranged so that the face of the instrument is placed at an appropriate angle making it easily visible to a seated operator. The voltmeter shall have a scale range of 0-50 volts d.c. with the dial colored as follows: 0-29 red, 30-38 white and 39-50 red.

(5) The housing referred to above shall have a dull finish outside and shall be attached to the operator's desk in such a manner as to provide easy access to the meter connections, and to facilitate removal of the voltmeter.

(6) Provision shall be made on the operator's desk for suitable 32 volt signal lights as specified in Section 6.09(20)(a).

(7) An indicator light and/or an audible signal as specified in Section 6.09(20)(b) shall be provided, showing that the friction brakes are applied.

(e) *Operator's Locker*

An operator's locker, located under the desk and to the right of circuit breaker cabinet, shall be provided and equipped with suitable metal hinged door and latch.

(f) *Cabinets for Circuit Breakers*

Unless otherwise specified in Section 6.09(21):

(1) A metal circuit breaker cabinet shall be located immediately to the right of the operator's position. The door of the cabinet shall be securely hinged and latched.

(2) The circuit breaker cabinet shall contain the headlight resistance unit, a 6 watt, 32 volt lamp with switch and the circuit breakers indicated on T.R.C. Drawing No. 3-11d4. All circuit breakers within this cabinet shall be marked plainly for the purpose of identification.

(3) A supplementary metal circuit breaker cabinet, equipped with a cover or door arranged to permit convenient access, shall be located adjacent to the center door. It shall contain the 600 volt circuit breakers and the track brake, and motor generator 32 volt circuit breakers.

3.11 Auxiliary Electrical Equipment (Cont'd)

(f) (3) (Cont'd)

Properly insulated terminals connected to the instrument shunt in the motor circuit also shall be provided therein.

(g) *Interior Illumination*

(1) Interior illumination shall be by means of an approved arrangement which will not produce objectionable glare, will not deteriorate rapidly in effectiveness through the collection of dirt, will not project unnecessarily below the level of the ceiling, will permit easy cleaning and easy renewal of lamps and will be free of rattle.

(2) The intensity of illumination at an elevation of 33" above the floor and on the upper surface of a transverse, 45° plane at passenger seats shall be not less than 12 foot-candles with 1 ampere lamps or not less than 20 foot-candles with 1.6 ampere lamps at 550 volts when the equipment is new, and shall be as uniform throughout the passenger seating area of the car as practicable.

(3) The arrangement of interior body lighting shall be as shown on T.R.C. Drawing No. 3-1b1 unless otherwise specified in Section 6.09(22). This shall include provision for adequate illumination of step-wells when doors are open and also of street or loading platform surface adjacent to the steps - all without glare in the eyes of a boarding or alighting passenger.

(4) For the 20-in-series type of lighting, a suitable short circuiting type of socket shall be used. Four lamps connected in at least two of the body circuits shall be mounted in the front destination sign as hereinafter specified.

(5) Lights in the front vestibule will be shielded to prevent glare in the operator's mirror. When specified in Section 6.09(22) these lights will be so wired that they go off when the doors are closed.

(6) The interior lighting circuits are to be controlled by a switch in the operator's gang switch hereinbefore specified.

(7) Emergency lights shall be installed when and as specified in Section No. 6.09(23).

(h) *External Lights*

(1) A headlight shall be furnished. This shall be fitted with a 32-32 candle power, twin beam, 12.5 volt, double contact bayonet prefocus type base lamp having an average

3.11 Auxiliary Electrical Equipment (Cont'd)

(h) (1) (Cont'd)

rated life of 500 hours. A resistance unit of suitable capacity and contained in the fuse cabinet specified hereinbefore shall be provided for series operation using a 32 volt d.c. circuit (37.5 volt maximum) as the source of power. The headlight shall be equipped with a reflector and lens of a design that, when equipped with the above lamp, will produce a candle power distribution meeting the specifications set forth in the American Transit Association Engineering Manual, Section E121. The design of headlight mounting shall be such as to permit accurate training of the beam both vertically and horizontally and to hold the headlight securely in the correct position. The range of the adjustable mounting shall be sufficient to permit aiming of the headlight so that the center of the maximum candle power zone of the upper (main) beam will coincide with a point located 25' in front of the car and 5" below the axis of the headlight mounting center.

(2) Two switches, as indicated on T.R.C. Drawing No. 3-11d4, shall be provided in the operator's gang switch to control the headlight. One shall turn the headlight on and off and the other shall regulate the position of the beam from upper to lower.

(3) The headlight mounting shall be so fitted to the dashboard as to be weatherproof.

(4) Two battery operated marker lights shall be installed at or near the rear corners of the car at about letter board elevation. The marker lights shall be fitted with 6 candle power, 12 volt bulbs and shall have ruby glass lenses. They shall be connected in parallel, and resistances of suitable capacity shall be furnished for operation from a 32 volt (37.5 volt maximum) circuit.

(5) Headlight and marker lights shall operate from the headlight switch as indicated on T.R.C. Drawing No. 3-11d4.

(6) Two stop lights, 6-1/2" diameter, shall be mounted on the rear dash and shall be connected to operate in parallel when the brake pedal is depressed. They shall be fitted with 21 candle power, 12 volt, double contact lamps, arranged to operate from a 32 volt (maximum 37.5 volt) circuit. The stop lights shall be fitted with amber or ruby lenses as specified in Section 6.09(24)(a).

(7) Two fixtures at the belt rail near the front corner of the car shall be provided for lights giving adequate illumination to the dash as specified in Section 6.09(24)(b).

3.11 Auxiliary Electrical Equipment (Cont'd)

(i) *Passenger Signals*

(1) The passenger signal system shall be cord operated. The cord shall be braided, 3/16" in diameter, with steel wire core and shall pass through approved guides and supports located near the bottom of the curtain molding.

(2) 32 volt pull type switches operated by the cords of the passenger signal system shall be installed, as specified in Section 6.09(25)(b).

(3) A signal buzzer, or single stroke chime, as specified in Section 6.09(25)(a) shall be located at the front end of the car under the window sill to the left of the operator's position. It shall be supplied at 32 volts (maximum 37.5 volts) from the storage battery.

(j) *Gong*

(1) A 12" diameter electrically operated gong of type specified in Section 6.09(26) shall be located under the front vestibule and properly protected from street wash.

(2) Operation shall be at 32 volts (maximum 37.5 volts) and by means of a gang switch.

(k) *Track Switch Throwing Equipment*

(1) A contactor and auxiliary resistance for throwing track switches by producing a current flow of 75 amperes shall be installed. They shall be properly located in the equipment compartment and controlled by the operator's gang switch. They shall be protected by an automatic thermal cut-out which should operate in 15 to 20 sec. When specified in Section 6.09(54) the handle of the gang switch controlling this contactor will be of a distinctive design; or

(2) When specified in Section 6.09(57), either of the following methods of throwing track switches may be used: The so-called necessity action switch which includes an extra contact in the trolley harp, or the so-called St. Louis Public Service Company method which uses the magnetic track brake to control the car while the switch is thrown with the power pedal.

3.12 Miscellaneous Car Body Items

(a) *Advertising Card Racks*

Advertising card racks shall be provided in the car interior between body corner posts, and shall be made to accommodate the standard advertising card of 11" height.

(b) *Bumpers and anti-Climbers*

(1) Combination bumpers and anti-climbers shall be mounted on the front and rear ends of the car. They shall extend well around the corners of the car, and their ends shall be so shaped as to conform to the architectural treatment of the car.

(2) These bumpers shall be made of steel channels as shown on T.R.C. Drawing No. 3-12b2 and shall include the at-

3.12 Miscellaneous Car Body Items (Cont'd)

(b) (2) (Cont'd)

tachment for the drawbar. They shall be bolted firmly to structural members of the vestibule framing with special bolts having oval heads.

(c) *Access to Roof*

(1) Access to the car roof shall be by attached folding steps, located as specified in Section 6.09(55).

(2) As shown on T.R.C. Drawing No. 3-12c2, the folding steps shall be of the hand grab type design. They shall be recessed into the pier post immediately to the rear of the center door as shown on T.R.C. Drawing No. 3-1b1. A rubber roof mat 3/16" thick with anti-slip treads shall be installed as shown on T.R.C. Drawing No. 3-12c2a. This mat shall extend along both sides of the ventilator housing, the trolley base shroud and the running boards, to a point as far to the rear as a man can stand on the roof. The rubber matting shall be cemented in place with a suitable cement, and its edges shall be fastened down in an approved manner.

(3) Two forged steel grab handles of suitable design to be inconspicuous and sufficiently strong shall be firmly attached to the roof carlines on either side of the above mentioned rubber mat, in a position to permit a man to grasp them conveniently in getting onto the roof.

(4) Two running boards shall be located on the roof and shall extend from the bonnet to a point ahead of the trolley base mounting. They shall be set on cleats cut to the roof contour and attached to the roof so as to avoid any possibility of leaks.

(5) Folding steps, grab handles, rubber mats and trolley boards shall provide a safe and convenient means of climbing to the roof and shall permit access to the rear vestibule roof without stepping on the unprotected roof metal or canvas.

(d) *Draw Bar and Sockets*

(1) A draw bar socket of the type specified in Section 6.09(27) shall be provided at each end of the car. The socket shall be so shaped as to permit pulling or pushing the car around a curve of 32' center radius.

(2) An aluminum coupling bar as shown on T.R.C. Drawing No. 3-12d2 shall be provided with each car, unless otherwise specified in Section 6.09(28). It shall be carried in a housing under one of the vestibules in such a way as not to rattle when the car is in motion, and so as to be readily accessible for removal.

3.12 Miscellaneous Car Body Items (Cont'd)

(e) *Dash Emblem*

When specified in Section No. 6.09(29) a dash emblem of chromium plated cast brass shall be furnished and installed on the front dash at the headlight.

(f) *Destination and Route Signs*

(1) Two roller curtain type illuminated signs shall be installed, one at the front of the car above the windshield, and one at the top of a body side window, as specified in Section 6.09(30)(a).

(2) The front sign shall be mounted in the front hood and shall conform in external appearance to the architecture of the car. Its glass shall be vertical. Unless otherwise specified in Section 6.09(30)(b), it shall provide a clear opening 50"x8". This sign shall be capable of displaying 6" letters as a maximum, and shall provide for rollers and curtains with 30 exposures unless otherwise specified in Section 6.09(30)(b).

(3) The front sign shall be so designed and installed that the inside of the glass can be cleaned readily from the vestibule of the car by swinging the entire box with enclosed mechanism around a vertical hinge at one end thereof. Provision shall be made for latching firmly in the closed position.

(4) The sign mechanism and curtain shall be easily removable. The mechanism of the front sign shall be so arranged that operation is by means of one or more handles conveniently located as Specified in Section No. 6.09(30)(c). No part of the mechanism shall be visible from outside the car.

(5) The front sign shall be illuminated by not less than four lamps in the sign box, similar to those installed in the car body and connected into at least two of the body illumination circuits.

(6) The side sign shall be contained in a box adapted to fit between side posts and shall be installed above the side window specified in Section 6.09(30)(a). The design shall be such that the box projects into the car interior to the minimum practicable extent and the finish shall match the interior finish of the car. The design shall be arranged so that the inside of the glass can be cleaned readily from the car interior by swinging the box and its enclosed mechanism about a horizontal hinge on its upper edge adjacent to the window. Provision shall be made for latching firmly in the closed position.

3.12 Miscellaneous Car Body Items (Cont'd)

(f) (Cont'd)

(7) This side sign shall provide for 4" high letters and 30 exposures unless otherwise specified in Section 6.09 (30)(b).

(8) The side sign shall be so arranged that it is illuminated by the car body lights.

(g) *Fare Collection Equipment*

Fare collection device or register, or both, as specified in Section 6.09(31), shall be furnished and installed. All mountings needed therefor shall be furnished and installed by Car Builder in accordance with drawings or written instructions of the Company.

(h) *Brake Signal*

Since emergency brake application is automatic, there shall be a light or audible signal indicating that one or more of the drum brakes are applied.

(i) *Jack*

When specified in Section 6.09(32), a car jack of the type therein specified, with necessary blocks and handle, shall be provided and suitably housed in a horizontal position in the bottom of the closet at the right of the motorman.

(j) *Life Guard*

(1) An approved design of life guard shall be mounted under the front end of the car.

(2) This guard and its operating mechanism shall be as light as practicable but shall be rugged enough to withstand the service required and shall not vibrate or rattle when the car is in motion.

(3) Provisions shall be made for easy resetting of the life guard from within the car.

(4) When specified in Section 6.09(33)(c) provision shall be made for a life guard hold-up device to permit uninterrupted operation over heavy snow. Control of this device shall be at a point convenient to the operator.

(5) The height above the rail of the trip gate and of the basket shall be as provided in Section 6.09(33)(a) and (b).

3.12 Miscellaneous Car Body Items (Cont'd)

(k) *Mirrors*

(1) Unless otherwise provided in Section 6.09(34), the car shall be equipped with a rear vision mirror and with a combination of mirrors which shall permit the operator to see distinctly the center door steps and part of the street area adjacent to the center door for a distance of approximately 6' beyond the side of the car.

(2) The rear view mirror shall be minimum 5" high by 12" wide and of the non-glare type. It shall be readily adjustable, but capable of maintaining its position securely when adjusted. It shall be so located as to permit the operator to see clearly the entire car interior and vehicles in the street behind the car.

(3) The combination of mirrors giving a view of the center door shall consist of a plane mirror 6" in diameter mounted near the right hand end of the front sign box, and a spherically convex mirror of 48" spherical radius and 12" diameter mounted adjacent to the center step-well. Both mirrors shall be so located that the line of vision between them is above the heads of standing passengers.

(4) All mirrors shall be made of good quality plate glass, free of waves and defects which would cause objectionable distortions. They shall be cold silvered with nitrate of silver, backed with a film of copper and coated with a high grade waterproofing.

(5) All mirrors shall be mounted with a metal back neatly spun over the edges of the glass, equipped with substantial and rugged mounting brackets that permit necessary adjustments to be made.

(l) *Operator's Shadow Apron and Night Curtain*

(1) When specified in Section No. 6.09(35)(a), a curtain which can be raised at night and held in the proper position to prevent reflection from the left hand windshield, shall be provided in front of the operator, under the gang switch desk.

(2) When specified in Section No. 6.09(35)(b) a hinged shield shall be provided. This shield lies under the right hand windshield during the day and at night can be raised and held in position to prevent reflection.

(3) When specified in Section 6.09(35)(c), an operator's night curtain shall be furnished and installed in accordance with drawing and/or written instructions of Company.

3.12 Miscellaneous Car Body Items (Cont'd)

(m) *Run Number Bracket*

When specified in Section 6.09(35)(c), a run number device or bracket shall be furnished and installed as provided in drawing or written instructions of Company.

(n) *Switch Iron*

(1) Unless otherwise specified in Section 6.09(37), a suitable switch iron of heat treated, high carbon steel shall be supplied with each car.

(2) The handle loop of this switch iron shall be left open to permit its use as a hook to pull down the trolley rope.

(3) When not in use the switch iron shall rest in a tubular or other approved holder inside the front vestibule and readily accessible to the operator. This holder shall either clamp the switch iron tightly or otherwise prevent rattling. It shall be designed so that the switch iron can be easily inserted and removed.

(o) *Sand Boxes*

(1) The car shall be equipped with sand boxes made of galvanized sheet iron and located as specified in Section No. 6.09(38)(a). The boxes shall be made as large as practicable with the sides inclined so that the sand will flow readily, and they shall be provided with heavy galvanized wire screens.

(2) The sand boxes shall be equipped with magnetically operated sand traps located beneath the floor of the car, and these shall be controlled by a gang switch. Provision also shall be made for automatic sanding with emergency braking.

(3) Sand shall be delivered from the sand traps to the rail in front of the leading wheels by means of a 2" inside diameter, 5 ply, air brake hose held in position by a steel brace and ending 3" above the rail with car empty and standing on wheels 25" in diameter.

(4) When specified in Section 6.09(38)(b) provision shall be made for filling the sand boxes from outside the car.

(p) *Trolley Catcher*

(1) The trolley catcher shall be of a quiet, streamlined design to conform to the architectural treatment of the car and shall be of the type specified in Section 6.09 (39)(a).

3.12 Miscellaneous Car Body Items (Cont'd)

(p) (Cont'd)

(2) It shall have capacity for and be supplied with 25' of Samson No. 8 Spot Cord, or approved equal, and sufficient opening to prevent friction of the cord on the edges of the casing.

(3) The trolley catcher shall be supplied with mounting bracket which shall latch the catcher firmly in place.

(4) It shall be mounted above the rear windows as shown on T.R.C. Drawing No. 3-12p4 unless otherwise specified in Section 6.09(39)(b). Care shall be taken to make sure that the trolley catcher is in the clear when the bumpers of two cars contact.

(q) *Windshield Wipers*

(1) Automatic windshield wipers of rugged design as specified in Section 6.09(40) shall be provided and installed on each half of the windshield. The wipers shall be electrically operated and their motion shall cover practically the entire windshield. When operated by individual motors, they shall be arranged so that they are individually controlled. The wiper operating mechanism shall be suitably concealed.

(2) A clutch shall permit the motors to run when the wipers stall.

(r) *Windshield and Operator's Desk*

The design and installation of the windshield and desk shall be as shown on T.R.C. Drawings No. 3-12r1 and 3-12r2.

SPECIFICATIONS FOR P. C. C. CAR

Effective April 1, 1947

SECTION 4 - MOTORS, BRAKES, CONTROL AND ACCESSORIES

4.01 General

(a) The arrangement of items under this section is intended to supply all pertinent information regarding the requirements under these Specifications. It is not intended, however, to indicate the grouping of equipment to be supplied by various classes of Manufacturers. All quotations submitted by Manufacturers shall refer specifically to the classifications of equipment as set up in Section 7.03 and shall indicate any modification from the list of items and parts indicated therein to be supplied under each classification.

(b) The different Manufacturers supplying parts or equipment covered by this section shall cooperate fully with each other and with the Car Builder and the Company, to the end that all apparatus shall be properly installed to insure satisfactory functioning and proper performance of the completed car in accordance with the requirements of this and all other sections of these Specifications.

(c) Attention is called to the guarantee provision of Section 1.04.

(d) Motors, brakes, control and all related equipment and apparatus shall be designed and built to provide an adequate margin of capacity and safety on the Company's property to prevent excessive maintenance or service interruptions under the weight and other specifications given herein, and with schedules demanding operating characteristics equivalent to those listed below.

4.02 Capacity of Operating Equipment

(a) The following operating factors are supplied for calculating the performance of the equipment to be furnished hereunder:

	Light Car	*Car With Average Load*
Total weight, light car	36,000 lb.	
Total weight, car & average passenger load		42,000 lb.
Average voltage at car	550	
Average grade resistance	5 lb/ton	5 lb/ton
Average resilient wheel resistance, total	6 lb/ton	6 lb/ton
Average acceleration	3.5 mph/sec.	3.5 mph/sec.
Maximum acceleration	4.95 mph/sec.	4.3 mph/sec.
Maximum dynamic braking rate	4.1 mph/sec.	3.6 mph/sec.

4.02 Capacity of Operating Equipment (Cont'd)

(a) (Cont'd)

	Light Car	*Car With Average Load*
Average deceleration (all dynamic)	3.6 mph/sec.	3.15 mph/sec.
Average length of run	1/8 mile	1/8 mile
Average length of stop	7 sec.	7 sec.
Coasting in percent of moving time, start to stop	25%	25%
Wheel diameter, new	25"	25"
Maximum wheel wear, diameter	2"	2"
Gear ratio	43 to 6	43 to 6

Every effort shall be made for the reduction of weight and equalization of load on each truck.

(b) The starting performance of the car on level tangent track, with total weight of 42,000 lb. and rail conditions providing adequate coefficient of adhesion shall be capable of meeting speed-time and distance-time relationships, in accordance with T.R.C. Drawing No. 4-2b1.

(c) The control shall be capable of producing, as nearly as practicable, a cycle of acceleration providing a smooth increase of acceleration from zero to 4.3 m.p.h./sec. in 1 to 1-1/2 sec., and the maintenance of constant acceleration at the latter value for a period of approximately 2 sec., with: full field, a total weight of 42,000 lb., 550 volts at the car, level tangent track, and rail conditions permitting adequate adhesion.

(d) The movement of the car under the action of the control, under all normal conditions, shall be sufficiently smooth to avoid disturbing changes of the forces acting on standing passengers. The average value of the rate of change of acceleration over any 1/4 sec. interval shall not exceed 5.5 m.p.h. per sec.^{2}. The period during which constant acceleration is maintained, shall not be less than 2 sec. by an amount greater than the time by which the period of growth of acceleration in paragraph (c) above exceeds 1 sec.

(e) The braking performance of the car on dry rail from a speed of 20 m.p.h. shall be capable of meeting the following requirements:

(1) Emergency braking rate, total weight 42,000 lb.; 6 to 7 m.p.h./sec.

(2) Service Dynamic braking rate, total weight 42,000 lb.: 3.15 m.p.h./sec.

4.02 Capacity of Operating Equipment (Cont'd)

(e) (Cont'd)

(3) Maximum rate of change of deceleration during service braking: 4.75 m.p.h./sec.^{2}.

(f) Under service braking the equipment shall be capable of producing a deceleration cycle under which the rate of deceleration of the car, with a total weight of 42,000 lb., shall increase smoothly from zero to 3.15 m.p.h./sec. in approximately one second, shall remain constant at the latter value until the speed is reduced to approximately 1-1/2 m.p.h. and shall then decrease uniformly to zero.

(g) The maximum dynamic brake application alone on dry and level tangent track with total car weight of 42,000 lb. shall be capable of producing a deceleration rate of 3.6 m.p.h./sec. with a maximum rate of change of deceleration of 4.75 m.p.h./sec.^{2}. The average value of this rate of change of deceleration over any 1/4 sec. interval shall not exceed 5.5 m.p.h./sec.^{2}.

(h) The drum brake system alone shall be designed to apply a deceleration force up to 3140" lb. torque at 2000 r.p.m. or approximately 20 m.p.h. This deceleration force is equivalent to the deceleration rates shown on T.R.C. Drawing No. 4-2h1.

(i) The lining of the drum brake shall be capable of providing at least 100,000 miles of normal service without renewal.

(j) In case of complete failure of the dynamic brake, the drum brake shall have sufficient capacity to provide entire braking service while removing car from service at speed not exceeding 20 m.p.h.

(k) Conveniently located means, at the sides of the trucks, shall permit the release of the drum brakes by hand in case automatic release fails and the car must be towed.

4.03 Motors

(a) Four motors per car, of 55 h.p. nominal capacity, shall each be wound for 300 volts and designed to be connected two in series for operation on 600 volts.

(b) Motors shall be of the high speed type and insulated with class B insulation. They shall be free of objectionable windage and commutator noises.

(c) Rotors shall be balanced dynamically within a maximum unbalance of 20 inch square ounces.

(d) Motors shall be standardized between Manufacturers with respect to mounting and other significant dimensions, terminals, etc., as required to make them interchangeable in trucks.

4.03 Motors (Cont'd)

(d) (Cont'd)

Significant dimensions of the motors are shown on T.R.C. Drawings No. 4-3d1 and No. 4-3d2. The lubrication holes of motor bearings shall be equipped with 1/8" pipe plugs to prevent unauthorized use of grease guns. Where drum brakes are used on motors, lubrication fittings may be used.

(e) The calculated balancing speed on level tangent track, with a total weight of 36,000 lb., wheel diameter 25", using the Davis formula for train resistance plus an allowance of 6 lb./ton for resilient wheels, shall be approximately 42 m.p.h. with 550 volts at the car.

(f) The safe maximum motor speed shall be not less than that corresponding to a car speed of 50 m.p.h. with wheels 24" in diameter.

(g) Electrical connections to the motors shall be of the compression type. The motor lead terminals shall be as shown on T.R.C. Drawing No. 4-3g1. They shall be held in place by means of the motor terminal clamping bridge shown on T.R.C. Drawing No. 4-3g2.

4.04 Motor and Brake Controls

(a) Operation of the motor and brake controls shall be by foot pedals which shall connect with the controls by means of push or pull rods as may be necessary. The foot pedals and operating rods shall be furnished and installed by Car Builder, complete and ready for connection to suitable points of attachment on the motor and brake control equipment. Both control pedals shall be located and arranged for convenient operation by the right foot, the brake pedal being placed to the left of the motor control pedal. The general arrangement of controls at the operator's position shall be as shown on T.R.C. Drawing No. 3-1k1.

(b) The force required for full depression of the motor control pedal shall not exceed 25 lb., and the force for full depression of the brake pedal shall not be more than 35 lb. The variation of pressure required between zero and full depression, on both pedals, shall be as uniform as practicable.

(c) *Safety Interlock Pedal*

(1) A two or three position safety interlock pedal, as specified in Section 6.09(56), shall be arranged for operation by the left foot. This pedal shall require a force not exceeding 12 lb. to hold it in the second or operating position.

(2) Releasing this pedal when the brake pedal is not in the latched position as described in 4.04(d) shall: open the

4.04 Motor and Brake Controls (Cont'd)

(c) (2) (Cont'd)

power circuit to the traction motors, produce full application of the drum brake and magnetic track brake, energize buzzer circuit* or gong (if of repeating type) and balance all doors.

(3) When a three position safety interlock pedal is specified in Section 6.09(56), a force not less than 40 lb. nor more than 60 lb. will trip the pedal into its third position. This will also open the power circuit to the traction motors, produce full application of the drum brake and magnetic track brake, energize buzzer circuit or gong (if of repeating type) and balance all doors.

* If a buzzer is used for passenger signal, same buzzer may be used; otherwise a special buzzer shall be provided.

(d) There shall be a "parking" latch position on the brake operating pedal. This shall be arranged so that when the brake pedal is depressed beyond this latch position and the safety interlock pedal is released, the brake pedal will lock or latch in a position applying not less than 75% of full drum brake action, and will also hold the safety interlock pedal in a position which permits the operator to leave his seat without causing the safety interlock to function as described in paragraph (c) above. In this parking latch position the magnetic track brakes shall not be energized, and the door control circuits shall remain energized for normal operation of the doors.

(e) The brake pedal shall also be arranged so that the operator can lock it easily in emergency position.

(f) Provision shall be made in the design to permit the substitution of hand operated control levers for foot operated pedals with a minimum of other changes.

(g) All motor and brake control equipment shall be standardized between Manufacturers to the greatest practicable extent, especially with respect to mounting dimensions and the motions required for their operation, so as to make equipments of competitive Manufacturers interchangeable. Motor and brake control equipment shall be combined as far as practicable into integral units instead of a collection of separately mounted parts. This equipment shall be installed under the car in weather-tight compartments provided for this purpose by the Car Builder, and equipped with adequately sealed, removable covers to permit ready access to apparatus for inspection and maintenance. The inside of the equipment compartments shall be painted white.

(h) Pins, rollers, guides and all other parts of the motor and brake control equipment, which are subject to wear that will alter the functioning of the control, shall be made of such

4.04 Motor and Brake Controls (Cont'd)

(h) (Cont'd)

materials and in such sizes as to minimize wear and shall be accessible for repair and replacement. Hardened and ground pins or equal shall be furnished throughout and shall be provided with approved self-lubricating bushings or with other approved means of insuring freedom from objectionable wear.

(i) Motor control shall be straight-parallel type with no provision for series-parallel transition. The functioning of the control shall be effected from 32 volt d.c. circuits, but the apparatus shall be designed to function satisfactorily in service on any voltage between 28 and 40.

(j) The motor control shall provide selection of any uniform accelerating rate between a minimum of 1.0 m.p.h./sec. and a maximum under average passenger load of 4.3 m.p.h./sec.

(k) The control shall be arranged so that when power is shut off, resistance is inserted in the motor circuit to act as a cushion before the line switch opens. This cushioning resistance shall be effective when shutting off power from any position of the control.

(l) Control of the dynamic brake shall be through a brake controller which shall be so interlocked with the motor controller that its operations will open the line switch and provide dynamic braking irrespective of the position of the master controller. The equipment shall also provide for sustained braking on descending grades.

(m) The complete brake system shall consist of a combination of dynamic brake, magnetic track brake and drum brake on the motor. The system shall be so designed that the drum brakes will not become effective until the dynamic braking fades, which shall normally occur at approximately 1-1/2 m.p.h.

(n) Movement of the brake pedal shall control brake functions in accordance with the following tabulation and T.R.C. Drawing 4-4n1, with reference to a car weight of 42,000 lb.

Inches of Brake Pedal Movement	*Drum Brake*	*Dynamic Brake*	*Track Brake*
3/10	Called for*	Starts	
1/2	1st step*		
1-5/8	2nd step*		
2-3/4	Maximum*		
3 (latch)		3.15 mph/sec.	
4-1/4			1st step
4-3/4			2nd step
5-1/4			3rd step
5-1/2		Maximum	
5-3/4 (Emergency latch)			
6 (total travel)			

* But locked out by relay during dynamic braking cycle.

4.04 Motor and Brake Controls (Cont'd)

(o) The deceleration produced by the dynamic brake shall increase uniformly with pedal travel between the starting point at 0.3" pedal travel and a rate of 3.15 m.p.h./sec. at 3" pedal travel. Thereupon the deceleration effect of dynamic brake shall remain constant until pedal travel reaches 5.5", whereupon it shall increase to 3.6 m.p.h./sec.

(p) The excitation current to track brake shall likewise increase in three steps, initial excitation at 4-1/4" pedal travel to a maximum at 5-1/4" pedal travel.

(q) Pressing the brake pedal through a distance of 6" shall: produce emergency application of dynamic and magnetic track brakes, and of drum brakes as dynamic braking fades, provide automatic sanding, energize the buzzer circuit or gong (if of repeating type) and balance all doors.

4.05 Power Accessories and Wiring

(a) Location of all power equipment and wiring thereto shall be studied cooperatively by all Manufacturers concerned, to the end that the most convenient, most accessible, and simplest arrangement for mounting, wiring, and maintenance can be achieved and standardized. Where practicable, it is desirable to have the wiring prefabricated into standard harnesses before installation. Where this is not practicable, the wires shall be installed in a standard manner, with the same arrangement and location in each car having similar equipment. In any case, the wires or harnesses shall be adequately supported to prevent motion or vibration when the car is in operation. All cable and wire shall be of approved type, conforming to Sections 2.08 and 2.09.

(b) A manually operated reverser shall be installed and this shall include the following positions: (1) bucking, (2) forward, (3) reverse, in the order named. Forward movement of the reverser lever handle shall correspond with forward movement of the car.

The design of this reverser lever handle shall incorporate a notching device, or equivalent, which shall enable the operator to determine readily by feel the position in which he places the reverser. The rod connecting the reverser lever handle and drum shall be furnished by Car Builder who shall also furnish the reverser lever handle shown on T.R.C. Drawings No. 4-5b1 or 4-5b1a.

(c) When use of back-up controller is specified in Section 6.09 (46), reverser lever handle shall be removable in the reverse position. When no back-up controller is specified, reverser lever handle shall be removable in bucking position.

4.05 Power Accessories and Wiring (Cont'd)

(d) Acceleration and deceleration control resistors shall be of approved light-weight type. They shall be located in the central control compartment under the car together with other control apparatus, so that they are properly cooled by the car ventilating system blower as specified in Section 3.10(b).

(e) A trolley base, pole and current collector of type specified in Section 6.09(41) shall be mounted on the roof in an approved manner to insure weather tightness and adequately long electrical leakage paths between live parts and the metal of the car body.

The support for the trolley base shall be located so that the center of the trolley base shall be 27" ahead of the center of the rear king pin and shall span at least 3 carlines. The trolley base shall be mounted on rubber springs as shown on T.R.C. Drawing No. 4-5e1, or approved equal, so that the mounting minimizes the transmission of vibrations from trolley pole to the car roof. The trolley base and its support shall be partially housed and masked in a streamlined metal enclosure of approved design, which shall present architecturally an appearance of continuity with the intake ventilator housing located ahead of the trolley base as provided in Section 3.10(l). The trolley base enclosure shall be adequately drained and electrically insulated from the car body steel.

(f) A hook shall be provided on the roof to hold the trolley pole in lowered position, and provision shall be made so that the pole will not strike the rear vestibule hood when pulled down.

(g) A lightning arrester of the type specified in Section 6.09 (42)(a) shall be provided and mounted on the trolley board and within the trolley base hood, unless otherwise specifically provided in Section 6.09(42)(b).

(h) When specified in Section 6.09(43), a main knife switch of approved type and properly enclosed, shall be supplied for mounting in an accessible position under the car floor. The enclosure shall be so arranged that it cannot be opened with the switch in the closed position or, alternatively, so that the switch is safely opened when opening the enclosure.

(i) When specified in Section 6.09(44), motor cut-out switches shall be installed under the car floor at the center section, with a handle extending through the floor. The various positions of the motor cut-out switch shall be suitably indicated with metal markers.

4.06 Track Brake

(a) Track brakes shall be suspended from the truck member connecting the journal housings and shall be carried between the wheels on each side of each truck, making four brake shoes per car.

4.06 Track Brake (Cont'd)

(b) Magnetic track brake shoes shall be 44" long over-all and the assembly shall be designed and built to produce the maximum practicable retarding force on the rail or rails used by the Company within acceptable weight and size limitations. The over-all height, measured from the bottom of the shoe when new, shall not be greater than 7-3/4". The parts contacting the rail head shall be made of such materials as to give maximum practicable life with minimum rail wear, and shall be easily and cheaply replaceable.

(c) A non-magnetic filler strip similar in hardness and wearing qualities to that of the pole pieces shall be installed the full length of each shoe between the pole pieces.

(d) The track brakes shall be lowered to the rail by their magnetic pull. The magnet coils housed in the track brake shoes shall be designed for excitation from a 32-volt (37.5 volt maximum) generator of a motor generator set in circuit with a 32 volt storage battery. Each shoe shall be capable of exerting a magnetic pull of 12,000 lb. at 10 amperes, when in contact with the rail.

4.07 Back-up Controller

(a) The purpose of the back-up controller is to enable the car to be operated backward at reduced speed from the rear end of the car. The brake pedal must be latched in the service brake position and the reverser lever handle placed in reverse position before it can be removed. This lever handle is then used to operate the back-up controller.

(b) The controller is designed so the reverse lever handle can be inserted or removed only in the brake applied position. The first movement of the lever handle to the left sets up coasting connection by releasing the brakes. Further movement to the left applies power. Return of the lever handle to the handle-off position applies dynamic and friction braking as set up by the latch position of the brake pedal at the front end. Movement of the lever handle to the right of the handle-off position adds a partial track brake application to dynamic.

(c) When specified in Section 6.09(46) a back-up controller will be installed. This controller will be used in conjunction with a safety interlock (push button) spring loaded switch which will cut off power and apply brakes when released. Furthermore, the controller will be so interlocked with the front end reverser that when the reverser handle is in the forward position unauthorized tampering with the back-up controller will not permit power to be applied or permit friction brakes to be released.

(d) The back-up controller will be so designed that it will return to center or handle-off position automatically.

4.07 Back-up Controller (Cont'd)

NOTE: While this specification primarily concerns single end, single car operation, it should be recognized that this equipment can be provided for double end and/or multiple unit operation, or metallic return.

SPECIFICATIONS FOR P.C.C. CAR

Effective April 1, 1947

SECTION 5 - TRUCKS

5.01 General

(a) Each car equipment shall consist of two, four wheel, swiveling trucks with two motors mounted on each truck, one geared to each axle, and with mud guards over wheels unless otherwise specified in Section 6.09(47). The trucks shall be of the type specified in Section 6.01(a) and shall be designed and built in accordance with the truck Schedule referred to therein.

(b) The trucks shall be completely assembled by the Truck Builder ready for operation, including the mounting of motors, wheels, magnetic track brakes and other brake equipment as specified in detail hereinafter. Trucks shall be delivered completely lubricated except at the center bearing.

(c) The Truck Builder shall supply the Company with a schedule of truck lubricants. This shall specify by trade names the lubricants recommended by the Truck Builder for the lubrication of different parts of the assemblage.

(d) Facilities shall be provided to permit adequate inspection of the parts,, sub-assemblies and completed trucks by the Company, in accordance with the requirements of Section 1.06.

5.02 Materials and Workmanship

(a) The parts shall be made of the best commercial grade of materials specified.

(b) All workmanship shall be of high grade and shall conform to the best manufacturing practices in all respects.

(c) All parts shall be finished within the dimensional limits given in the Truck Builder's drawings which, when accepted, become part of these Specifications.

(d) All welding shall conform to the requirements of Section 2.07. Welds shall not have less than the thickness shown on Truck Builder's drawings which, when acepted, become part of these Specifications.

(e) Cap screws, bolts and nuts shall be S.A.E. Aircraft Standard as given in the latest edition of S.A.E. Handbook.

(f) All bolts and screws shall be securely locked. Bolts shall be locked unless the nut is locked on the bolt itself.

5.03 Weights and Dimensions

(a) The weight of the empty car body to be supported on these trucks shall be 20,000 lb. without roof ventilation.

(b) The maximum calculated passenger load shall be 18,200 lb., giving a total on the center bearings of 38,200 lb. without roof ventilation.

(c) The maximum normal fore and aft force to be transmitted between truck and car body shall be that corresponding to a deceleration of 9 m.p.h./sec. with maximum passenger load. Peak values approaching 12 m.p.h./sec. may be reached.

(d) The balancing speed shall be 42 m.p.h. and the safe maximum speed shall be 50 m.p.h.

(e) The wheel gauge of the trucks shall be as specified in Section 6.01(c).

(f) The trucks shall be designed for wheels having a nominal diameter when new of 25" and clearances and adjustments shall be provided for 2" diametral reduction by wear. Tolerances on wheel diameter are given in Section 5.12(b).

(g) The nominal floor level of the car without passenger load, static condition, and 25" wheels shall be 32½" above the head of the rail. When the completely equipped empty car body is first loaded on the trucks, the floor level shall stand at 32¾" plus ¼", minus 0".

(h) The floor level of the car with full passenger load, static condition, 25" wheels and ¼" allowance for permanent set of the spring, shall be not less than 30¾" plus ¼", minus 0" above the head of the rail.

(i) Clearances shall be provided to permit the floor level of the car to drop to 30" above the head of the rail with full passenger load, maximum dynamic deflection, 25" wheels and ¼" allowance for permanent set of the springs.

(j) Clearances shall also be sufficient to permit raising any one axle 8" above the level of a plane passing through the three other axles when car is empty, and 6" with full passenger load.

5.04 Design Features

(a) The principal purposes to be achieved in the truck design are:

(1) Low first cost and weight.

(2) Quiet operation, free of objectionable vibrations.

(3) Satisfactory riding qualities.

(4) Ease and economy of maintenance.

5.04 Design Features (Cont'd)

(b) The truck structure shall consist essentially of a rectangular frame which shall be designed to be as rigid as possible. However, it shall permit independent vertical displacement of any one wheel with respect to the others. The frame shall also function to resist the torque of the motors and brakes when accelerating or braking.

(c) Motors shall be so supported that they are entirely spring borne. Adequate provision shall be made for proper support on the truck of all flexible cables and electrical leads to motors or track brakes.

(d) The car body shall be carried on a bolster capable of swinging laterally 1-1/2" each side of the center. The point at which horizontal forces are transmitted between car body and truck shall be at a height above the rail approximating the center line of the axles.

(e) Accelerating and braking forces shall be transmitted through the truck bolster supports.

(f) All brake equipment and mechanism on the trucks, including track brake parts, shall be mounted so that necessary functions can be performed without the development of lost motion and rattling due to wear of parts.

(g) Whenever electrical insulation is hereinafter specified between mechanical parts of the truck structure to prevent electrical leakage, this is intended to protect anti-friction bearings from the destructive effect of ground circuit current flowing through them. All such electrical insulation shall be capable of withstanding a potential of 100 volts permanently, without disruption, while being drenched with water.

5.05 Axles

(a) The axles shall have a nominal diameter of 4" and shall be made of a steel as provided in Section 2.02(b).

(b) Axles may be made of forged or rolled stock, heat treated and drawn to produce the physical properties specified in Section 2.02(b).

(c) All straightening operations shall be completed before final heat treatment.

(d) The Manufacturer shall maintain a record of the heat number of all axles and each axle shall be permanently marked on its end so that the number of the heat from which it was made can be determined at any future time.

(e) The axle shall be finish ground over all cylindrical and fillet surfaces to dimensions as specified.

5.05 Axles (Cont'd)

(f) Fillets of not less than 1" radius shall be used at all changes of section except as otherwise specifically provided.

(g) Axles which are galled or otherwise scarred when pressing on the gear hub shall be rejected. In the absence of visible evidence of such scarring, the use of a pressing force of more than the maximum specified hereinafter shall be taken as evidence for rejection of the assembly.

5.06 Journal Bearings

(a) Journal bearings shall be of the anti-friction type with diametral dimensions nominally corresponding to the 100 millimeter size or No. 20 light series. Dimensions, materials and construction shall be such as to insure an average life of 750,000 miles under street railway operating conditions on cars having the characteristics herein specified.

(b) The journal bearings shall be mounted so as to exert no locating action in an axial direction.

(c) The inner races of the journal bearings shall be pressed in position on the axles, and the outer races shall fit lightly in the journal housing with the fits prescribed by the bearing Manufacturer.

(d) The journal bearings shall be fitted on both ends with labyrinth or other seals, as approved for this application.

5.07 Transmission

(a) The design of transmission shall be provided in the truck Schedule attached hereto.

(b) Suitable orifices and plugs shall be provided in the transmission housing for lubrication service and breathing. The breather shall be so arranged as to prevent the entrance of water.

(c) All transmission bearings shall be of sufficient capacity to insure an average life of not less than 750,000 miles under the conditions of operation specified herein.

(d) Adequate provision shall be made to prevent oil leakage around the pinion shaft.

(e) The pinion shaft shall be splined to match with the half of the universal joint adjacent to the transmission. The fit shall be S.A.E. 10-A.

(f) When assembled, the gear and pinion shall be adjusted to bear with a proper amount of back lash as indicated on the gear by the manufacturer. Each transmission shall be run, on a

5.07 Transmission (Cont'd)

(f) (Cont'd)

test stand, up to a speed of 4,000 r.p.m. against a brake or other resistance sufficient to indicate that operation of the assembly in service will be quiet as judged by automotive standards.

5.08 Axle Housing Ground and Plugs

(a) The axle housing shall carry a brush and brush holder for shunting ground current to the axles around the anti-friction bearings. The brush shall have an area of not less than 1-1/2 sq. in. and shall contact a ring made of S.A.E. 62 bronze pressed on the axle.

(b) The brush and its holder shall be protected against mechanical injury and dirt by a housing having a cover easily movable for access. The brush shall be electrically insulated from the axle housing and shall be so mounted as to provide readily attachable means for connecting it electrically to the ground connection. The electrical insulation between brush and axle housing shall be adequate to prevent electrical leakage when the assembly has been well wetted.

(c) Magnetic Plugs shall be installed in the drain holes in the gear and journal housings of each axle assembly.

5.09 Springs

(a) Nominal dimensions and loads for use in the design of truck springs are as follows:

Car floor level over rail with empty body	32-3/4"
Minimum floor level in service	30"
Maximum spring deflection from light car, static load to maximum dynamic load	2-3/4"

(1) If B-2 trucks are used:

Nominal weight of body	20,000 lb.
Part weight of trucks on main springs	6,700 "
Weight on springs with empty body	26,700 "
Maximum calculated passenger load	18,200 "
Maximum static weight on springs	44,900 "
Allowance for dynamic action (25%)	11,200 "
Maximum vertical dynamic load on all springs	56,100 "
Maximum vertical dynamic load on all main springs at one side of the car	28,050 "
Allowance for lateral forces 40% of 26,700 = 10,680 lbs.	
Vertical component of lateral forces 38 x 10,680 ÷ 58.5 =	6,940 "
Maximum load on the springs at one side of the car	34,990 lb.

5.09 Springs (Cont'd)

(a) (Cont'd)

(2) If B-3 trucks are used:

Nominal weight of body	20,000	lb.
Part weight of trucks on main springs	1,000	"
Weight on springs with empty body	21,000	"
Maximum calculated passenger load	18,200	"
Maximum static weight on springs	39,200	"
Allowance for dynamic action (25%)	9,800	"
Maximum vertical dynamic load on all springs	49,000	"
Maximum vertical dynamic load on all main springs at one side of the car	24,500	"
Allowance for lateral forces 40% of 21,000 = 8400 lb.		
Vertical component of lateral forces 38 x 8400 ÷ 58.5 =	5,460	"
Maximum load on springs at one side of the car	29,960	"

(b) In case of roof ventilation, account shall be taken of the additional weight.

(c) For the loads imposed and the deflections permitted, the basic load deflection curve of truck springs shall be such as to provide uniform performance of the springs throughout the range of loading.

(d) Unless otherwise specified in Section No. 6.09(48), the spring system shall consist of a combination of rubber and steel coil springs so designed that a maximum flexibility is secured in the steel springs while the rubber springs assist in supporting the added static and dynamic loads and in damping vibration and noise.

(e) When the car body is placed on the trucks, a straight edge resting on opposite window sills shall be parallel to the level of the track within 1/2", measured at the sides of the car. If a greater deviation exists, the Car Builder shall correct this condition by the insertion of shims in the springs.

5.10 Magnetic Track Brakes

(a) Two magnetic track brake shoes shall be mounted on each truck by the Truck Builder.

(b) The shoes shall be mechanically connected and spaced crosswise of the truck by means of a steel cradle. The spacing between shoes shall be as specified in Section 6.09(45)(b). The fastening of the brake shoes to the cradle shall be so made as to permit changing the transverse center to center distance of shoes to the extent of plus 3/8", minus 0" by the addition of washers, shims or equivalent.

5.10 Magnetic Track Brakes (Cont'd)

(c) The cradle specified above shall carry the magnetic track brake shoes so that the center line of the shoe is vertical.

(d) The assemblage of shoes and cradle shall be suspended resiliently in such manner that the shoes, when new, ride approximately 1/4" above the head of the rail, and ample adjustment shall be provided for the maintenance of this dimension as the shoes and wheels wear. The assembly and its mounting shall permit the shoes to ride over track and special work irregularities. The track brake structure and its mounting shall be strong enough to withstand a longitudinal shock equivalent to a force of 10,000 lb. applied at the end of one brake shoe assembly.

(e) The spring suspension of the assembly shall be so designed as to permit the brake shoes to be drawn to the rail when excited by a current not greater than 3 amperes per shoe. This suspension shall have a load deflection characteristic per shoe of 300 lb. per in. of deflection ±10%.

(f) The suspension assembly and stops for transmission of braking forces shall be arranged to prevent rattling.

(g) The suspension shall be electrically insulated from the supporting brackets. This insulation shall be adequate to prevent electrical leakage when the assembly is drenched with water.

5.11 Damping Means

(a) Each truck shall be equipped with the necessary means to absorb by friction the energy of the vertical, rolling and swaying oscillations of the body in the service the car is intended to perform.

(b) As these oscillations vary with the lines on which the cars are operated, and as an excess of damping is prejudicial to good riding, damping means shall be ordered according to conditions of service.

(c) In order to accomplish this purpose, the trucks shall be equipped with minimum damping means and provided with facilities for attachment of additional means, which shall be installed by the Truck Builder as required and specified in Section 6.09(49).

(d) Hydraulic shock absorbers and friction snubbers using friction of rubber against steel are acceptable.

(e) Connections between the shock absorbers and the axle housing or the truck frame shall incorporate a resilient member so designed as to prevent the objectionable transmission of sharp impulses. At the same time this member shall provide electrical insulation between the axle housing and the truck frame.

5.12 Wheels

(a) Wheels shall be of a resilient type as selected by the Company and specified in Section 6.01(a), and shall be designed and built in accordance with the wheel Schedule referred to therein.

(b) The nominal gauge diameter shall be 25" and provision shall be made for 2" diametral wear. The tape measure shall be 244, plus 6, minus 4, with not more than 25% of the wheels below 244.

(c) The wheels shall be mated with respect to tape size by the Manufacturer and shall be shipped and mounted in pairs. The tape size shall be stamped on the outside of each wheel in such manner that this marking will be readily readable after shipment.

(d) Contour of wheel tire shall be as specified in Section 6.09 (50).

(e) The inner face of the wheel hub shall be cupped to prevent concentration of stress in the axle when mounted. The bore shall be so related to the diameter of the seat on the axle, that its finish shall be such as to require a force of not less than 40 nor more than 75 tons to press the wheel on the axle when lubricated with white lead.

(f) When finally mounted on the axle the gauge of the wheels shall not vary from that specified in Section 6.01(c) by an amount greater than ±1/16".

5.13 Painting

(a) The finished trucks shall be thoroughly cleaned of all dirt and oil and they shall then be sprayed with one coat of approved metal primer by the Truck Builder before shipment.

(b) As provided in Section 2.06(1) trucks shall be given an additional coat of paint by Car Builder before installation under the car.

SPECIFICATIONS FOR P. C. C. CAR

Effective April 1, 1947

SECTION 7 - DIMENSIONS AND WEIGHTS, BILLS OF MATERIAL AND DRAWINGS

7.01 General Dimensions of Basic Car

(a) The general dimensions and tolerances of the basic car shall be as follows:

	DIMENSIONS		Tolerance,
	Feet	Inches	in.
Length over anti-climbers	46	5-3/8	±3/8
Length of front vestibule (body corner post to outside of anti-climber)	7	2-3/16	±1/8
Length of rear vestibule (body corner post to outside of anti-climber)	5	9-3/16	±1/8
Length over body corner posts	33	6	±1/4
Body bolster center distance	22	9	±1/4
Width over-all, maximum	8	4	±1/8
Height, rail to top of floor, 25" wheels, car light, static, after 1/4" settlement of springs	2	8-1/2	+1/4-0
Height, rail to top of floor, 25" wheels, 18,200 lb. passenger load after 1/4" settlement of springs			
(static)	2	6-3/4	-
(dynamic)	2	6-1/8	-
Height, rail to top of first step, car light, static, after 1/4" settlement of springs	1	3	±1/4
Height, risers of remaining steps	-	8-25/32	±1/16
Depth, first tread, entrance and exit, nose to nose projection	1	-	-
Depth, second tread, entrance and exit, nose to nose projection	-	10	-
Depth, undercut of risers	-	1	-
Height, rail to bottom of step well framing, car light, static, after 1/4" settlement of springs	1	1/2	+1/4-0
Height, rail to bottom of skirt, car light, static, after 1/4" settlement of springs	1	1/2	+1/4-0
Height, floor to top of window sill	2	7-5/16	±1/16
Height, floor to bottom of letterboard	4	2-5/16	±1/8
Height, floor to bottom of standee window opening	5	1-3/4	-
Height of standee window opening	-	7	-
Height, rail to top of roof, car light, static, after 1/4" settlement of spring	10	2-7/8	±1/4

7.01 General Dimensions of Basic Car (Cont'd)

(a) (Cont'd)

	DIMENSIONS		Tolerance, in.
	Feet	Inches	
Height of trolley shroud above roof at center	1	1/8	-
Width of trolley shroud	2	9-3/8	-
Height, floor to ceiling, center of width	7	1-1/2	±1/4
Center to center of window posts	2	4-1/2	±1/16
Door openings, face to face of posts, center door	5	6	±1/8
front door	5	5	±1/8
Height, floor covering to bottom of raised sash (minimum and not including rubber sealing strip)	4	5/16	±1/8
Rise of sash (minimum)	-	11	-
Height, door opening over first step	6	6	+1/4-0
Width of aisle at top of seat back	2	2-7/8	-
Width of aisle at seat cushion or frame	2	2-7/8	-
Width, double seat cushion	2	9	-
Height, front edge of seat cushion	1	5	-
Angle of seat back (to vertical) . . . 16°	-	-	-
Height of seat back (top of grab rail)	2	10-3/16	-
Wheel diameter, new	2	1	-
Radial wheel wear allowed for	-	1	-

(b) For the basic car (100" wide) the over-all dimensions of the car body shall be as shown on T.R.C. Drawing No. 3-1a1. No part of the car body shall fall outside the limits shown on this drawing. For a 104" or 108" car, the dimensions in width shall be increased by 4" or by 8" respectively, as specified in Section 6.01(a) and as shown on T.R.C. Drawings No. 3-1a2 and 3-1a3.

7.02 Weights

(a) The weights shall be approximately as listed below:

(1) Car body completely equipped, ready for mounting on trucks . . . . . 20,000 lb.

(2) Trucks completely equipped, ready for reception of car body and for making of all connections thereto . . . . . " -

(3) Complete car ready for service . . . . . 36,000 "

(4) Additional weight for pressure ventilation . 1,200 "

(b) The Car Builder shall weigh each complete car before shipment and shall also weigh a sufficient number of completely equipped trucks to establish their average weight. He shall transmit to the Company and to the Transit Research Corporation a record of such weights.

7.03 Bills of Material and Equipment

(a) *General*

This schedule provides a list of material, equipment and parts required for a complete car constructed under these Specifications, but any failure to enumerate any part or parts required to complete a fully functioning car within the intent of these Specifications shall not relieve the respective Manufacturers of equipment, Car Builder or Truck Builder from supplying such parts, except with respect to parts furnished by the Company, as indicated in Section 6.02.

(b) *Car Body*

(1) One metal car body including:

*Steel Roof
*Wooden floor
*Floor covering
*Step wells with nosings and plastic filler
Step well barriers
*Door leaves
Curtain moldings
Headlining
Side-lining
Advertising rack
Built-in equipment compartments with covers and mountings
Built-in wire ducts
*Sand boxes
Battery compartment complete with doors, vent, tray and hold-down clamps
Operator's elevated platform
Power, brake and foot interlock pedals with control rods and levers
Ducts for ventilation of propulsion motors and car including dampers, control rods, springs, levers, thermostats and necessary thermal insulation
Motor ventilating bellows
Flexible motor cables with rubber covered terminals
All necessary wiring, not supplied as part of electrical equipment
Roof matting
Equipment for access to roof
*Roof intake ventilator
Trolley base mounting and shroud
Bumpers and anti-climbers
*Draw bar sockets and coupling bar

(2) Specialties

*1 set of passenger seats
*1 adjustable operator's seat

*Option provided on this item, See Section 6.09.

7.03 Bills of Material and Equipment (Cont'd)

(b) (2) (Cont'd)

*1 set lighting fixtures
*1 set sash and windshields for all windows, glazed and complete with raising mechanism for movable sash
*1 set roller window curtains
*1 set stanchions and hand rails
*1 set windshield wipers with control switch
*1 trolley catcher with rope, snaphook and bracket
*1 passenger signal system
*1 set door operating equipment, consisting of:

Basic equipment:

4 door operators
4 sets operating levers, rods and gears
4 sets magnetic relays and control
1 outside switch for front door

Safety interlock equipment:

1 set door interlock switches
1 alarm bell
1 set of 4 treadles
1 set of sensitive edges
2 door relays
1 power relay

*1 life guard with tray, trip gate hold-up device, and operating mechanism
*1 set route and destination signs for front hood and side window
1 headlight, complete with resistance for 12 volt bulb
*2 rear stop lights, complete with resistance for 12 volt bulbs
2 marker lights, complete with resistance for 12 volt bulbs
*1 set window guards
*1 set auxiliary heaters consisting of:

6 heater spindles, each 1666 watts unmounted but with terminals
1 thermostat
2 damper operators, less connecting rods, springs and damper mechanism
1 resistor (900 ohms)
1 condenser (.07 mfd)

*1 operator's fan with bracket
1 vestibule heater
*1 storage battery - 32 volts - with terminals, connectors and external connector for body wiring

*Option provided on this item, see Section 6.09.

7.03 Bills Of Material and Equipment (Cont'd)

(b) (2) (Cont'd)

*1 electric gong - 32 volts
*1 12" convex mirror
1 5" x 12" rear view mirror with bracket
*1 6" flat mirror with bracket
*1 set signal lights on operator's desk
*1 switch iron and holder

(c) *Brake Equipment*

(1) 4 friction brakes (supplied by Clark Equipment Company or Westinghouse Air Brake Company)

(2) 1 five circuit three position foot interlock switch (supplied by Consolidated Car Heating Company)

(3) 1 set track brake equipment as follows: (supplied by General Electric or Westinghouse Air Brake)

4 track brake shoes, 44" long, complete with No. 6 AWG extra flexible cable, attaching bolts, nuts and washers, and wound for 32 volts.

1 lot cable for track brake circuits

1 track brake resistor (mounted on master controller)

(4) 1 set brake actuator equipment as follows: (supplied by General Electric or Westinghouse Air Brake)

4 friction brake actuators
1 friction brake signal device
1 lot cable for brake actuator circuits
1 resistor and lockout relay (mounted on master controller)

(d) *Trucks*

**2 trucks
**8 resilient wheels
2 track brake spreaders and spring suspensions

(e) *Motor and Control Equipment*

Supplied by General Electric Company or Westinghouse Electric Corporation. This bill of material is typical only. For exact list of items see proposal submitted by electrical Manufacturers.

*Option provided on this item, see Section 6.09.
** " " " " " " " 6.01.

7.03 Bills of Material and Equipment (Cont'd)

(e) (Cont'd)

(1) Motors

4 Motors 55-Hp, 300/600 volts with plug type terminals

(2) Main control

1 Contactor group
1 Motor controller or accelerator
1 Line breaker
1 Master power and braking controller with limit relay and meter shunt
1 Current collector equipment
1 Lightning arrester
1 Set main resistors
1 Set field shunting equipment
1 Lot cable for motor control circuits

(3) Gang Switch

1 Gang switch assembly

(4) Heater Contactor

1 Heater contactor (mounted on auxiliary panel)

*(5) Track Switch Throwing Equipment

1 Track switch contactor (mounted on auxiliary panel)
1 Resistor unit
1 Lot cable for track switch circuits

(6) Motor Generator and Auxiliary Panel

1 Motor generator set 600/40 volt with two fans
1 auxiliary panel including:

1 contactor for MG motor
1 contactor for MG generator
1 generator voltage regulator
1 resistor for MG starting
1 interlock for MG alarm
1 heater contactor
1 track switch throwing contactor with thermal relay

The following additions to the base propulsion equipment should be specified when required:

*(7) Main Switch

1 Main knife switch in wooden box

*Option provided on this item, see Section 6.09.

LIST OF DRAWINGS

7.03 Bills of Material and Equipment (Cont'd)

(e) (Cont'd)

*(8) Motor Cutout Switch

1 Motor cutout switch
1 Lot cable for cutout switch circuits

*(9) Back-up Equipment

1 back-up controller
1 lot cable for back-up circuits
1 pushbutton safety interlock switch

(10) Circuit Breakers or fuses for 32 Volt Circuits

1 set circuit breakers or fuse blocks and fuses for 32 volt circuits

(11) Circuit Breakers or Fuses for 600 Volt Auxiliary Circuits

1 set circuit breakers or fuse blocks and fuses for 600 volt auxiliary circuits

*(12) Battery Switch

1 Battery disconnect switch

*(13) Voltmeter

1 battery voltmeter, 0-50 volt scale

(14) Metallic circuit, double end, and multiple unit equipment are also available.

*Option provided on this item, see Section 6.09.

7.03 Bills of Material and Equipment (Cont'd)

(f) *Characteristics of Wires and Cables*

The list of wires and cables to be furnished for the various purposes and by the several Manufacturers are tabulated below:

(1) For Propulsion Equipment

(a) Supplied by Westinghouse Electric Corporation

Cable Size A.W.G.	*Circuits on Which Wires Are To Be Used*	*Nominal Thickness of Insulation*		*Stranding*	*Bare Diam.*	*Maximum Outside Diam.*	*Covering*
		Rubber	*Asbestos*				
3/0	Trolley and Ground....	5/64"	-	259/.0255"	0.533"	0.85"	2 Braids
1	Motor (Car Body).....	5/64"	-	19/.0664"	0.33"	0.61"	1 Tape 1 Braid
1	Accelerator Compartment	-	0.125"	19/.0664"	0.33"	0.61"	Asbestos
1	Motor Leads on Truck..	5/64"	-	259/.0179"	0.376"	0.75"	Neoprene Jacket
6	Lightning Arrestor, Field Shunt, Track Switch Resistor, Back-up Control.....	4/64"	-	7/.0612"	0.184"	0.41"	1 Tape 1 Braid
		4/64"	-	7/.0612"	0.184"	0.41"	
12	Control	3/64"	-	19/.0179"	0.09"	0.24"	1 Braid
12	Control (In Accel. Compt.)	-	0.105"	19/.0179	0.09"	0.31"	Asbestos

(b) Supplied by General Electric Company

Cable Size A.W.G.	*Circuits on Which Wires Are To Be Used*	*Nominal Thickness of Insulation*			*Stranding*	*Bare Diam.*	*Max. Outside Diam.*	*Covering*
		GRS Rubber	*Varnished Cambric*	*Asbestos*				
1/0	Trolley and Ground.....	-	5/64"	-	275/.0201"	0.460"	0.75"	1 Tape 1 Braid
3	Motor (Car Body)..	-	4/64"	-	125/.0201"	0.261"	0.50"	1 Tape 1 Braid
3	Resistor Compartment....	-	-	4/64"	133/.0199"	0.299"	0.546"	Asbestos
1	Motor Leads on Truck....	5/64"	-	-	259/.0179"	0.376"	0.750"	Neoprene Jacket
6	Lightning Arrester, Field Shunt, Track Switch Throwing, Back-up Control.....		4/64"		61/.0201"	0.181"	0.42"	1 Tape 1 Braid
		-	4/64"	-	61/.0201"	0.181"	0.42"	
6	Field Shunt, Track Switch Resistor....	-	-	4/64"	133/.0141"	0.212"	0.456"	Asbestos
12	Control.....	-	3/64"	-	19/.0179"	0.090"	0.290"	1 Tape 1 Braid

SPECIFICATIONS FOR P. C. C. CAR

Effective April 1, 1947

SECTION 7 - DIMENSIONS AND WEIGHTS, BILLS OF MATERIAL AND DRAWINGS

7.01 General Dimensions of Basic Car

(a) The general dimensions and tolerances of the basic car shall be as follows:

	DIMENSIONS		Tolerance,
	Feet	Inches	in.
Length over anti-climbers	46	5-3/8	±3/8
Length of front vestibule (body corner post to outside of anti-climber)	7	2-3/16	±1/8
Length of rear vestibule (body corner post to outside of anti-climber)	5	9-3/16	±1/8
Length over body corner posts	33	6	±1/4
Body bolster center distance	22	9	±1/4
Width over-all, maximum	8	4	±1/8
Height, rail to top of floor, 25" wheels, car light, static, after 1/4" settlement of springs	2	8-1/2	+1/4-0
Height, rail to top of floor, 25" wheels, 18,200 lb. passenger load after 1/4" settlement of springs			
(static)	2	6-3/4	-
(dynamic)	2	6-1/8	-
Height, rail to top of first step, car light, static, after 1/4" settlement of springs	1	3	±1/4
Height, risers of remaining steps	-	8-25/32	±1/16
Depth, first tread, entrance and exit, nose to nose projection	1	-	-
Depth, second tread, entrance and exit, nose to nose projection	-	10	-
Depth, undercut of risers	-	1	-
Height, rail to bottom of step well framing, car light, static, after 1/4" settlement of springs	1	1/2	+1/4-0
Height, rail to bottom of skirt, car light, static, after 1/4" settlement of springs	1	1/2	+1/4-0
Height, floor to top of window sill	2	7-5/16	±1/16
Height, floor to bottom of letterboard	4	2-5/16	±1/8
Height, floor to bottom of standee window opening	5	1-3/4	-
Height of standee window opening	-	7	-
Height, rail to top of roof, car light, static, after 1/4" settlement of spring	10	2-7/8	±1/4

Duplicated

7.01 General Dimensions of Basic Car (Cont'd)

(a) (Cont'd)

	DIMENSIONS		Tolerance, in.
	Feet	Inches	
Height of trolley shroud above roof at center	1	1/8	-
Width of trolley shroud	2	9-3/8	-
Height, floor to ceiling, center of width	7	1-1/2	±1/4
Center to center of window posts	2	4-1/2	±1/16
Door openings, face to face of posts, center door	5	6	±1/8
front door	5	5	±1/8
Height, floor covering to bottom of raised sash (minimum and not including rubber sealing strip)	4	5/16	±1/8
Rise of sash (minimum)	-	11	-
Height, door opening over first step	6	6	+1/4-0
Width of aisle at top of seat back	2	2-7/8	-
Width of aisle at seat cushion or frame	2	2-7/8	-
Width, double seat cushion	2	9	-
Height, front edge of seat cushion	1	5	-
Angle of seat back (to vertical) 16°	-	-	-
Height of seat back (top of grab rail)	2	10-3/16	-
Wheel diameter, new	2	1	-
Radial wheel wear allowed for	-	1	-

(b) For the basic car (100" wide) the over-all dimensions of the car body shall be as shown on T.R.C. Drawing No. 3-1a1. No part of the car body shall fall outside the limits shown on this drawing. For a 104" or 108" car, the dimensions in width shall be increased by 4" or by 8" respectively, as specified in Section 6.01(a) and as shown on T.R.C. Drawings No. 3-1a2 and 3-1a3.

7.02 Weights

(a) The weights shall be approximately as listed below:

(1) Car body completely equipped, ready for mounting on trucks . . . . . 20,000 lb.

(2) Trucks completely equipped, ready for reception of car body and for making of all connections thereto . . . . . 16,000 "

(3) Complete car ready for service . . . . . 36,000 "

(4) Additional weight for pressure ventilation . 1,200 "

(b) The Car Builder shall weigh each complete car before shipment and shall also weigh a sufficient number of completely equipped trucks to establish their average weight. He shall transmit to the Company and to the Transit Research Corporation a record of such weights.

LIST OF DRAWINGS

SCHEDULES