

SPECIFICATIONS FOR RAPID TRANSIT CARS

SECTION 12

MISCELLANEOUS ELECTRICAL EQUIPMENT AND WIRING

12.01 Motor-Generator-Blower

(a) A motor-generator set shall be provided on each single-car unit, and on the "A" car only of two-car units.

(b) Two centrifugal type blowers, of approved type, shall be mounted on the motor-generator set with rotors directly assembled on extensions of the armature shaft. Each blower shall discharge into the adjacent resistor compartment 1000 cfm. or a total of 2000 cfm. of air and shall operate without objectionable noise. The rotor shall be divided into two sections and so arranged as to blow an additional 1000 cfm. of air into the duct systems directed towards the traction motors.

(c) The motor-generator set and blowers shall each be dynamically balanced and shall be mounted on a common base, supported on rubber bushings and securely fastened in place. The set, when operating under full load shall have a nominal speed of 1750 r.p.m. at 600 volts, and shall be capable of safe and ample performance at any supply voltage between 450 and 650. The motor-generator set shall be arranged for ready removal and replacement, for inspection, servicing and adjustment.

(d) The motor of the motor-generator set shall have sufficient capacity to simultaneously drive the generator delivering all power required for controls and other auxiliary equipment; for charging the storage battery described in Section 12.02 of these specifications; and to drive the blowers at rated capacity.

(e) The generator of the motor-generator set shall have sufficient capacity to charge the battery described in Section 12.02 of these specifications, 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 40 volts with any power rail voltage between 450 and 650 volts.

(f) The motor-generator set shall be equipped with regulating devices as required to perform all its functions properly and safely. The regulated voltage shall be continuously adjustable between 35 and 40 volts and shall hold the adjustment under all operating conditions, including operation over gaps in power rail.

(g) The "B" car of two-car units shall be provided with a motor-driven blower set with blowers attached, and shall comply with all applicable provisions of this section of the Specifications.

(h) The driving units of the motor-generator-blowers

and blowers shall be so interlocked with the traction motor control so that when blowers cease to operate, power cannot be applied to the traction motors.

12.02 Storage Battery

(a) Each car equipped with a motor-generator set shall be provided with a 32-volt storage battery of approved nickle-iron-alkaline type having sufficient capacity to meet the load requirements and duty cycle for the type of service described.

(b) All bateries shall be connected in parallel through the B+ train line with a 0.1 Ohm resistance in series with each battery.

(c) A battery cut-out switch of approved design shall be provided and installed in a suitable location.

(d) Battery containers shall be properly vented.

12.03 Cab Switch Panels

(a) Switch boxes with hinged covers shall be built into the side and rear of each motorman's cab to house the electrical apparatus as described below. The panels shall be made of a material of approved quality suitable for switchboards. Each panel shall carry the necessary apparatus, so arranged as to be easily accessible to connections, and designed to prevent an operator from coming into contact with live parts when operating switches or replacing fuses. All switches and fuses shall be provided with a name plate clearly identifying the circuit which each controls.

(b) Switches for 600 volts shall be of the toggle-action, indicating type. Switches which must not be operated under load shall be plainly marked with words "Must not be operated under load - 600 volts".

(c) Fuses for 600 volts shall be so mounted as to require the 600-volt line to be disconnected from the fuse before renewal

(d) All 32-volt battery circuits shall be provided with circuit breaker type switches as manufactured by General Electrical Company, or approved equal, and shall clearly indicate "OFF" and "ON" positions.

(e) Separate switch panels shall be provided for 32-volt and 600-volt apparatus.

(f) All control switches in the motorman's cab shall be grouped in a switch box located adjacent to the control equipment. Switch boxes shall be arranged so that only the operating handles of the switches extend through the cover, which shall be plainly marked to indicate the position of the switch, and to identify the circuits controlled.

(g) A voltmeter to indicate battery voltage, and all indication lights except the motorman's door signal light, shall be grouped on a panel and mounted in the motorman's cab at a location that

may conveniently be seen by the motorman. Indication lights shall be plainly marked.

(h) Both control switch box and signal light panel shall be arranged for easy access for maintenance.

12.04 Power Rail Contact Shoes and Fuses

(a) Each truck shall be provided with a power rail contact shoe on each side of the truck. Shoes shall be of Railroad standard design or approved equal, and shall be mounted to gauge and adjustable as to height in accordance with Railroad drawing.

(b) Contact shoes shall be properly insulated from the truck frame for 650 volts, and mounting shall be of an approved type.

(c) Each contact shoe shall be provided with a fuse box of moulded composition type, Horne Company or approved equal. Contact shoe fuse boxes shall be properly insulated from truck frames to prevent flashover, and so mounted to facilitate removal of fuses.

(d) A flexible shunt of approved type shall be provided between contact shoe and fuse. Approved terminals shall be provided for making connection to truck trolley lead.

(e) The truck trolley lead shall be securely fastened to the truck frame and car body, and so

designed to provide adequate flexing without contact with wayside structures.

12.05 Grounding and Guarding

(a) A flexible ground lead shall be provided from the car body to each truck, and from the frame supporting the motor to the ground brushes of each axle. The car body and ground lead connection shall be of the spark plug type or approved equal.

(b) All unguarded non-current-carrying metal parts subject to becoming charged which are not thoroughly insulated shall be grounded.

(c) All current-carrying parts connected to circuits with potential of more than 150 volts, except power rail shoes, shall be insulated, or located or guarded to prevent accidental contact.

(d) All doors and cover plates guarding current-carrying equipment in circuits having a potential of more than 150 volts shall be securely fastened in place, and the inside kept marked with the word "DANGER - 600 VOLTS".

12.06 Wiring and Conduit

(a) All car wiring circuits shall conform to the latest revision of the "National Board of Fire Underwriters Regulations for Electric Cars and Trolley Buses". All wire used shall be of approved type and quality and shall carry

Underwriter's Laboratory approval.

(b) The layout of wiring shall be designed in advance of its installation and in cooperation with manufacturers of connected equipment.

Insofar as practicable, all wiring shall be fabricated on the bench into convenient units and installed in prefabricated groupings and standardized locations. Wiring installed in conduits shall not be cabled. Grounding connections shall be brazed and bolted or welded and bolted to car body steel.

(c) 600-volt wiring and 32-volt battery wiring shall not be placed in same conduit, ducts or cables. Wiring connected to apparatus shall be insulated for maximum voltage carried by any part of the apparatus.

(d) All wiring shall be run in conduit of adequate size in an approved manner. Conduit shall be approved aluminum alloy tubing and securely fastened. Compression fittings shall be used.

(e) All wires and terminal studs shall be plainly and suitably marked so that circuits may be easily identified, and these markings shall conform to standard wire numbering system shown on TRC drawing, No. 9-1.

(f) Diagramatic drawings of all circuits shall be submitted to the Railroad for approval prior to installation.