

MELBOURNE AND METROPOLITAN TRAMWAYS BOARD

Z3 CLASS TRAM - MELBOURNE, AUSTRALIA

CONTRACTOR

Commonwealth Engineering (Vic.) Pty. Ltd.,
Frankston Road,
Dandenong, Victoria, Australia.

in conjunction with -

A.E.G.-Telefunken (Berlin),
DUWAG (Dusseldorf)

DESCRIPTION

A tram designed for use in Melbourne. The tram is double-ended non-articulated with four axles in two trucks. The trams can be operated as single units only and are not equipped to be coupled. They are fitted with thyristor (Chopper) control electrical equipment which provides smooth, jerk free acceleration and regenerative braking.

These trams are being built to continue the replacement of W2 class trams. The body is an improved form of Z1 and Z2 Class previously supplied by Comeng.

DEVELOPMENT STATUS

Order placed 3 April, 1978.

First tram into service on 25 September, 1979.

100 trams on order to be delivery at approx. rate of 25 trams per year.

PERFORMANCE - SEATED LOAD

| | |
|----------------------------------|------------------------|
| Speed (max.) | 70 km/hr |
| Grade (max.) | 9% |
| Acceleration (max.) | 1.6m/sec. ² |
| Retardation (service max. cont.) | 1.6m/sec. ² |
| Retardation (emergency) | 3.0m/sec. ³ |
| Jerk (max.) | 1.3m/sec. |
| Horizontal curve radius (min.) | 16.3m |
| Vertical curve radius (min.) | 138m |

CAPACITY

42 seats
83 standees (Area per standee based on 6 per metre²)
125 total

DIMENSIONS

| | |
|---|-----------|
| Length | 16,740 mm |
| Width (outside) | 2,670 |
| Height - rail to roof | 3,410 |
| Floor height above rail | 850 |
| Width (inside) | 2,540 |
| Headroom at centre line | 2,140 |
| Aisle width | 690 |
| Doorway width - clear opening between handrails | 1,260 |
| Doorway height | 2,264 |
| Step heights - | |
| Ground to first step at tare (new wheels) | 334 |
| Other 2 steps | 258 |

MASS

| | |
|--------------------|-----------|
| Tare | 21,800 Kg |
| Laden (crush load) | 30,130 Kg |

TRUCKS

| | |
|-------------------------------------|---------------------------------|
| Type | In-board bearing, monomotor |
| Design | DUWAG, Dusseldorf, West Germany |
| Construction of frames and bolsters | Welded steel by Comeng (Vic.) |
| Assembly | M.M.T.B. at Preston Workshops |
| Gauge | 1,435 mm |
| Axle centres | 1,800 mm |
| Wheels | Bochum 54, resilient |
| Wheel diameter | 660 mm |
| Motors | Monomotors (1 per truck) |

A.E.G. - type ABS 3322 self ventilated designed for thyristor control, laminated stator. Continuous rating 195 kW at 600 volts.

TRUCKS (contd.)

| | |
|---------------------------------------|---|
| Gears | Thyssen Henschel - Hypoid, right angle drive, hollow shaft with spider type flexible rubber coupling. Ratio 1:5.666. |
| Service brakes | Electro-dynamic, regenerative operation down to 8 km/hr. |
| Low speed, parking and stand-by brake | Spring applied caliper pads, to ventilated brake disc (Knorr-Bremse), one per each axle. Pads hydraulically released. |
| Hydraulic system | Hydraulic pump and actuator mounted on truck (Hanning and Kahl). |
| Emergency brakes | Electro dynamic plus electro-magnetic track brakes |
| Suspension | Primary - Chevron rubber Secondary - Clouth rubber rolling ring type plus rubber plate springs. |
| Axle bearings | SKF twin spherical roller races. |
| Dampers | 2 vertical, 1 transverse. |
| Coupling to body | Large diameter roller race incorporating angular movement stops. |
| Mudguards | Fibreglass. |

ELECTRICAL CONTROL SYSTEM

| | |
|----------------------|--|
| Line voltage | 600 volts, D.C. |
| Line current (max.) | 550 Amps |
| Power collection | Trolley pole with MMTB carbon block collector head. |
| Power control system | A.E.G. Thyristor "Chopper" using independent chopper systems to each truck. This power system also provides the regenerative braking capability. |

ELECTRICAL CONTROL SYSTEM (contd.)

| | |
|---------------------|---|
| Control system | Siemens electronic control. |
| Emergency control | In addition to the duplicity of the chopper system, a switch is provided to by-pass most of the electronic control system and thereby provide "get home" capability at reduced performance. |
| Overspeed control | Automatic power shut-off and brake application held down to 7 km/hr. |
| Wheel spin and slip | Detection and correction provided with automatic sanding. |
| Controls | Foot operated, 3 pedals (accelerator, brake and safety pedals). |
| Indications | Hand operated sand, gong, disc brake, points, turn indicators, and doors, speedometer, battery voltmeter and indicator lights. |
| Motor alternator | 3 phase claw pole generator without slip rings. Outputs at 220V and 22V at 100 Hertz. Coupled to 600V D.C. motor. Rating 3.3KVA. |
| Battery | Lead acid, 171 Amp.hr. |

BODY

| | |
|---------------------------|---|
| Numbers | 116 to 215. |
| Frame | Steel - all welded. |
| Truck centres | 8500mm |
| Exterior walls | Aluminium |
| Roof | Fibreglass |
| Interior walls | Stressed steel covered with teak finish laminate. |
| Lining, ceiling and coves | Fibreglass. |
| Insulation | 50mm glass fibre. |
| Floor | Plywood over corrugated steel surfaced with "Treadmaster" (cork and neoprene rubber). |

BODY (contd.)

| | |
|-------------------------------|---|
| Windows | 7 per side Beclawat "Tempest", half drop (anti-sun) glass. |
| Doors | Aluminium framed, Beclawat, 2 four leaf folding doors and one two leaf folding door per side. |
| Door operators Door system | Electric (Vapor Corporation, (U.S.A.)). Safety interlocked with tram motion. Uses step treadle mats and pressure pulse sensitive door edges. |
| Ventilation | Four exhausting fans mounted in pods above ceiling, each 50 cubic metres per minute operating on thermostatic control above 25°C ambient at half speed and at full speed above 30°C ambient. |
| Heating | 8 electric heaters, individually thermostatically controlled located under passenger seats and conductor's stations. Fans operated on 220V system and heater elements on 600V, 1 kW each. Driver's heater-demister 2 kW each. |
| Seating | Upholstered over high resilience fire retarded polyurethane foam, (Hendiform). |
| Destination equipment | "Brose", polyester blind type, back lit, lower case letters. |

WORK EXECUTED AT PRESTON TRAM WORKSHOPS

Truck assembly

Manufacture - fibreglass dash and canopy

Manufacture and installation of -

all passenger seat frames and upholstery

conductor's consoles (45° type)

fibreglass seat surrounds

Installation of staunchions and rails

Manufacture and installation of current collection equipment.