<table>
<thead>
<tr>
<th>Application</th>
<th>Electric System</th>
<th>Output Power (Continuous)</th>
<th>Cooling Method</th>
<th>Characteristics/Features</th>
<th>Page No.</th>
</tr>
</thead>
</table>
| **Commuter Train**  | 600 V DC        | 120 kW*1 x 4              | Natural cooling | Unit of Control: 1C1M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 400 V AC - 198 A                                                                                                                      | 5, 6     |
|                     | 750 V DC        | 135 kW x 4                | Natural cooling | Unit of Control: 1C2M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 550 V AC - 360 A                                                                                                                  | 2        |
|                     |                 | 170 kW*1 x 4              | Natural cooling | Unit of Control: 1C2M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 550 V AC - 360 A                                                                                                                  | 1        |
|                     |                 | 135 kW x 4                | Natural cooling | Unit of Control: 1C2M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 550 V AC - 360 A                                                                                                                  | 3        |
|                     | 1500 V DC       | 140 kW*1 x 4              | Natural cooling | Unit of Control: 1C1M× 4  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 990 V AC - 153 A                                                                                                                  | 7        |
|                     |                 | 175 kW*1 x 4              | Natural cooling | Unit of Control: 1C2M or 1C4M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 940 V AC - 132 A                                                                                                                  | 8        |
|                     |                 | 175 kW*1 x 4              | Natural cooling | Unit of Control: 1C1M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 990 V AC - 132 A                                                                                                                  | 11       |
|                     |                 | 140 kW*1 x 4              | Natural cooling | Unit of Control: 1C4M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1100 V AC - 413 A                                                                                                                  | 10       |

*1: Rating is 1 hour
<table>
<thead>
<tr>
<th>Application</th>
<th>Electric System</th>
<th>Output Power (Continuous)</th>
<th>Cooling Method</th>
<th>Characteristics/Features</th>
<th>Page No.</th>
</tr>
</thead>
</table>
| Commuter Train    | 3000 V DC                        | 210 kW x 4                | Forced air cooling   | Unit of Control: 1C4M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 2300 V AC - 268 A                                                                                           | 15       |
|                   | 25 kV AC – 60 Hz                 | 200 kW x 4                | Natural cooling      | Unit of Control: 1C4M  
Circuit configuration: 3 Level, single phase, voltage type VVVF Converter + 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1370 V AC - 412 A                                                                                           | 17       |
| Cruise Train      | Diesel Electric Hybrid (600V)    | 130kW** x 4               | Water cooling        | Unit of Control: 1C4M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 450 V AC - 215 A                                                                                           | 18       |
|                   | Diesel Electric 1500 V DC        | 140kW** x 4               | Natural cooling      | Unit of Control: 1C4M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1100 V AC - 372 A                                                                                           | 19       |
| High-Speed Train  | 25 kV AC – 60 Hz                 | 285 kW x 4                | Forced air cooling   | Unit of Control: 1C4M  
Circuit configuration: 3 level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1850 V AC - 448                                                                                           | 20       |
| Locomotive        | 20 kV AC – 50 Hz                 | 565kW* x 1                | Forced air cooling   | Unit of Control: 1C2M  
Circuit configuration: 3 Level, single phase, voltage type PWM Converter + 3 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1550 V AC - 1100 A                                                                                           | 22       |
|                   | 25 kV AC – 50 Hz                 | 1250 kW x 3               | Water cooling        | Unit of Control: 1C1M  
Circuit configuration: 2 Level, single phase, voltage type VVVF Converter + 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 2150 V AC - 390 A                                                                                           | 23       |
|                   | 25 kV AC – 50 Hz                 | 1430 kW x 2               | Water cooling        | Circuit Configuration: 2 Level, single phase, voltage type PWM Converter + 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 1780 V AC - 552 A                                                                                           | 24       |
| Tram              | 750 V DC                         | 140 kW x 2                | Forced air cooling   | Unit of Control: 1C2M  
Circuit configuration: 2 Level, 3 phase, voltage type VVVF Inverter  
Output Rating: 3 phase - 550 V AC - 412 A                                                                                           | 26       |

*1: Rating is 1 hour
## Auxiliary Power Unit Product Line-up

<table>
<thead>
<tr>
<th>Application</th>
<th>Electric System</th>
<th>Capacity</th>
<th>Cooling Method</th>
<th>Characteristics/Features</th>
<th>Page No.</th>
</tr>
</thead>
</table>
| **Commuter Train**   | 750 V DC        | 140 kVA  | Natural cooling      | Input Voltage: 750 V DC  
                        |                 |          |                      | Circuit Configuration: 2 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 300 V AC - 50 Hz  
                        |                 |          |                      | Endurable Overload: 150% - 10 sec          | 2        |
|                      | 1500 V DC       | 260 kVA  | Natural cooling      | Input Voltage: 1500 V DC  
                        |                 |          |                      | Circuit Configuration: 3 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 440 V AC - 60 Hz  
                        |                 |          |                      | Endurable Overload: 150% - 10 sec          | 10       |
|                      | 3000 V DC       | 206 kVA  | Forced air cooling   | Input Voltage: 3000 V DC  
                        |                 |          |                      | Circuit configuration: 2 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 380 V AC - 50 Hz  
                        |                 |          |                      | Endurable Overload: 160% - 10 sec          | 15       |
|                      | 25 kV AC – 60 Hz| 195 kVA  | Natural cooling      | Input Voltage: 469 V AC  
                        |                 |          |                      | Circuit configuration: Converter + 2 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 440 V AC - 60 Hz  
                        |                 |          |                      | Endurable Overload: 150% - 10 sec          | 17       |
|                      |                 | 110 kVA  | Forced air cooling   | Input Voltage: 404 V AC  
                        |                 |          |                      | Circuit configuration: Converter + 2 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 220 V AC - 60 Hz  
                        |                 |          |                      | Endurable Overload: 200% - 10 sec          | 16       |
| **High-Speed Train** | 25 kV AC – 50 Hz| DC: 36 kW, AC: 5 kVA | Natural cooling | Input Voltage: 440 V AC  
                        |                 |          |                      | Circuit configuration: Converter + Inverter  
                        |                 |          |                      | Output Rating: single phase - 110 V AC - 60 Hz, DC 100 V  
                        |                 |          |                      | Endurable Overload: 5.5 kVA - 50 sec        | 20       |
| **Locomotive**       | 25 kV AC – 50 Hz| 230 kVA  | Water cooling        | Input Voltage: 399 V AC  
                        |                 |          |                      | Circuit configuration: Converter + 2 Level CVCF/ VVVF Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 380 V AC - 50 Hz  
                        |                 |          |                      | Endurable Overload: 350 kVA - 10 sec        | 23       |
|                      | 25 kV AC – 50 Hz| 230 kVA  | Water cooling        | Input Voltage: 304 V AC  
                        |                 |          |                      | Circuit configuration: Converter + 2 Level CVCF/ VVVF Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 380 V AC - 50 Hz  
                        |                 |          |                      | Endurable Overload: 350 kVA - 10 sec        | 24       |
|                      | 20kV AC - 50 Hz 25kV AC - 50 Hz | 150 kVA  | Forced air cooling   | Input Voltage: 1366/ 1389 V AC  
                        |                 |          |                      | Circuit configuration: Converter + Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 440 V AC - 60 Hz  
                        |                 |          |                      | Endurable Overload: 300 kVA - 30 sec        | 22       |
| **Tram**             | 750 V DC        | 30 kVA   | Forced air cooling   | Input Voltage: 750 V DC  
                        |                 |          |                      | Circuit configuration: 2 Level Inverter  
                        |                 |          |                      | Output Rating: 3 phase - 208 V AC - 60 Hz, 1 phase - 120 V AC - 60 Hz  
                        |                 |          |                      | Endurable Overload: 45 kVA - 30 sec         | 26       |

*1: Rating is 1 hour
## Traction Motor Product Line-up 1/1

<table>
<thead>
<tr>
<th>Application</th>
<th>IM (ASM)<strong>1 or PMSM</strong>2</th>
<th>Continuous Rating</th>
<th>Cooling Method</th>
<th>Characteristics/Features</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commuter Train</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM (ASM)</td>
<td></td>
<td>135 kW</td>
<td>Self-ventilation</td>
<td>Truck-mounted 4P - 3 phase - 550 V - 180 A - 2040 rpm Class 200</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>140 kW</td>
<td>Self-ventilation</td>
<td>Truck-mounted 4P - 3 phase - 490 V - 215 A - 2745 rpm Class 200</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>190 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Truck-mounted 4P - 3 phase - 940 V - 134 A - 2080 rpm Class 200</td>
<td>12</td>
</tr>
<tr>
<td>PMSM</td>
<td></td>
<td>140 kW(1h)**3</td>
<td>Self-ventilation</td>
<td>Truck-mounted 4P - 3 phase - 1050 V - 108 A - 2380 rpm Class H</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240 kW</td>
<td>Self-ventilation</td>
<td>Truck-mounted 4P - 3 phase - 1380 V - 125 A - 3755 rpm Class H</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>140 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Truck-mounted 6P - 3 phase - 990 V - 153 A - 2000 rpm Class 200</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>190 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Truck-mounted 6P - 3 phase - 980 V - 134 A - 2000 rpm Class 200</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>190 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Truck-mounted 6P - 3 phase - 990 V - 130 A - 2000 rpm Class 200</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>205 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Truck-mounted 6P - 3 phase - 880 V - 168 A - 2300 rpm Class H</td>
<td>5, 6</td>
</tr>
<tr>
<td><strong>High-Speed Train</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM (ASM)</td>
<td></td>
<td>285 kW</td>
<td>Forced air cooling</td>
<td>Truck-mounted 4P - 3 phase - 1850 V - 112 A - 3400 rpm Class 200</td>
<td>20</td>
</tr>
<tr>
<td>IM (ASM)</td>
<td></td>
<td>1150 kW</td>
<td>Forced air cooling</td>
<td>Nose-suspended 6P - 3 phase - 2000 V - 410 A - 1585 rpm Class 200</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>565 kW(1h)**3</td>
<td>Forced air cooling</td>
<td>Nose-suspended 6P - 3 phase - 1100 V - 370 A - 1470 rpm Class H</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1430 kW</td>
<td>Forced air cooling</td>
<td>4P - 3 phase - 1780 V - 552 A - 1663 rpm Class 200</td>
<td>24</td>
</tr>
<tr>
<td>PMSM</td>
<td></td>
<td>80 kW(1h)**3</td>
<td>Totally-enclosed</td>
<td>Nose-suspended 6P - 3 phase - 440 V - 117 A - 550 rpm Class 200</td>
<td>21</td>
</tr>
<tr>
<td><strong>Locomotive</strong></td>
<td></td>
<td>750 V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>140 kW</td>
<td>Totally-enclosed (Outer fan cooling)</td>
<td>Truck-mounted 6P - 3 phase - 550 V - 206 A - 2770 rpm Class 200</td>
<td>26</td>
</tr>
</tbody>
</table>

**1: AC Induction Motor (Asynchronous Motor)**  
**2: Permanent Magnet Synchronous Motor**  
**3: Rating is 1 hour**
In 2015, Toshiba, together with Marubeni Corporation, provided a railway system as a full package, including rolling stock, power supply systems, signaling and control systems and communication systems to the Mass Rapid Transit Authority of Thailand for the Thailand MRT Purple Line. For the train electric equipment, Toshiba provided traction and auxiliary power systems for 21 train sets comprised of 63 cars.

Toshiba supplied traction system, train information system, auxiliary power system, air-conditioning system, and other electric equipment to Kita-Osaka Kyuko Railways for their 9000 Series commuter cars. In April 2014, commercial operation has started.

**Electric Equipment for Kita-Osaka Kyuko Railways 9000 Series, Japan**

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Kinki Sharyo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Kita-Osaka Kyuko Railways</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2014</td>
</tr>
<tr>
<td>Country</td>
<td>Japan</td>
</tr>
<tr>
<td>Electric System</td>
<td>750 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>70 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>322.0 t</td>
</tr>
</tbody>
</table>

**Compact and Light-weight Traction Inverter**

- Output Power (kW): 170 x 4
- Weight (kg): 1300
- Dimensions (W x D x H mm): 3850 x 1135 x 674
- Cooling Method: Natural cooling

**Traction Motor**

- Output Power (kW): 170
- Weight (kg): 605
- Dimensions (Ø x W mm): 540 x 510
- Cooling Method: Totally-enclosed

**Traction Inverter**

- Output Power (kW): 135 x 4
- Weight (kg): 900
- Dimensions (W x D x H mm): 3850 x 1055 x 710
- Cooling Method: Natural cooling

**PMSM**

- Output Power (kW): 170
- Weight (kg): 605
- Dimensions (Ø x W mm): 540 x 510
- Cooling Method: Totally-enclosed

**Long and Compact Traction Motor**

- Output Power (kW): 135
- Weight (kg): 546
- Dimensions (Ø x W mm): 436 x 779.5
- Cooling Method: Self-ventilation

**Auxiliary Power Unit with Dead Battery Starter**

- Output Power (kW): 140
- Weight (kg): 1690
- Dimensions (Ø x W x H mm): 3610 x 850 x 670
- Cooling Method: Natural cooling

**Electric Equipment for Purple Line, Thailand**

In 2015, Toshiba, together with Marubeni Corporation, provided a railway system as a full package, including rolling stock, power supply systems, signaling and control systems and communication systems to the Mass Rapid Transit Authority of Thailand for the Thailand MRT Purple Line. For the train electric equipment, Toshiba provided traction and auxiliary power systems for 21 train sets comprised of 63 cars.

**Vehicle Manufacturer**

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<tr>
<th>Vehicle Manufacturer</th>
<th>J-TREC (Tokyu Sharyo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Bangkok Expressway and Metro Public Company Limited</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2015</td>
</tr>
<tr>
<td>Country</td>
<td>Thailand</td>
</tr>
<tr>
<td>Electric System</td>
<td>750 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>80 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>113.8 t (Mc-car: 39.8 t, T-car: 34.2 t, Train configuration: 2M1T)</td>
</tr>
</tbody>
</table>

**Commuter Train**

- Vehicle Manufacturer: J-TREC (Tokyu Sharyo)
- Operator: Bangkok Expressway and Metro Public Company Limited
- Start of Supply: 2015
- Country: Thailand
- Electric System: 750 V DC
- Track Gauge: 1435 mm
- Maximum Operating Speed: 80 km/h
- Vehicle Weight: 113.8 t (Mc-car: 39.8 t, T-car: 34.2 t, Train configuration: 2M1T)

**Commuter Train**

- Vehicle Manufacturer: Kinki Sharyo
- Operator: Kita-Osaka Kyuko Railways
- Start of Supply: 2014
- Country: Japan
- Electric System: 750 V DC
- Track Gauge: 1435 mm
- Maximum Operating Speed: 70 km/h
- Vehicle Weight: 322.0 t

**High-Speed Train**

**Locomotive**

**Commuter/Cruise Train**

**Tram**
Toshiba supplies traction system and train information system for the 7000 Series Railcars of the Washington Metropolitan Area Transit Authority (WMATA) in the Washington DC Area, USA. Base contract is 364 cars.

### Electric Equipment

#### for Singapore C151 Series, Singapore

In line with the initiative of Singapore's SMRT Trains Ltd. to refurbish its C151 series trains, Toshiba started to supply PMSM (Permanent Magnet Synchronous Motor) and Traction Inverter for eight C151 series cars in 2015.

#### Traction System and Train Information Systems for WMATA 7000 Series, USA

Toshiba supplies traction system and train information system for the 7000 Series Railcars of the Washington Metropolitan Area Transit Authority (WMATA) in the Washington DC Area, USA. Base contract is 364 cars.

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<tr>
<th>Vehicle Manufacturer</th>
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<tr>
<td>Operator</td>
<td>SMRT Trains Limited</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2015</td>
</tr>
<tr>
<td>Country</td>
<td>Singapore</td>
</tr>
<tr>
<td>Electric System</td>
<td>750 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>80 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>222.2 t (Train configuration: 4M2T)</td>
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<th>Vehicle Manufacturer</th>
<th>Kawasaki Rail Car (KRC)</th>
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<tr>
<td>Operator</td>
<td>Washington Metropolitan Area Transit Authority (WMATA)</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2012</td>
</tr>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Electric System</td>
<td>700 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1429 mm (4 ft., 8 1/4 in.)</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>121 km/h (75 mph)</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>441 t (970,000 lbs.) (4M2T, Basic train configuration: 4M2T)</td>
</tr>
</tbody>
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<tr>
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<tr>
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<td>USA</td>
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<tr>
<td>Electric System</td>
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<tr>
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<tr>
<td>Maximum Operating Speed</td>
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</tr>
<tr>
<td>Vehicle Weight</td>
<td>441 t (970,000 lbs.) (4M2T, Basic train configuration: 4M2T)</td>
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<td>Electric System</td>
<td>700 V DC</td>
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<tr>
<td>Track Gauge</td>
<td>1429 mm (4 ft., 8 1/4 in.)</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>121 km/h (75 mph)</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>441 t (970,000 lbs.) (4M2T, Basic train configuration: 4M2T)</td>
</tr>
</tbody>
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<th>Traction System and Train Information Systems for WMATA 7000 Series, USA</th>
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<tbody>
<tr>
<td>Operator</td>
<td>Washington Metropolitan Area Transit Authority (WMATA)</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2012</td>
</tr>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Electric System</td>
<td>700 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1429 mm (4 ft., 8 1/4 in.)</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
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<td>Electric System</td>
<td>700 V DC</td>
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<tr>
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<td>Electric System</td>
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<tr>
<td>Maximum Operating Speed</td>
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</tr>
<tr>
<td>Vehicle Weight</td>
<td>441 t (970,000 lbs.) (4M2T, Basic train configuration: 4M2T)</td>
</tr>
</tbody>
</table>
PMSM Traction Systems for Tokyo Metro Co., Ltd., Japan

Toshiba supplied PMSM traction system for 240 commuter cars of Tokyo Metro’s 1000 Series. For 16000 Series, Toshiba also supplied PMSM traction system for 160 commuter cars.

1000 Series

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Nippon Sharyo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Tokyo Metro Co., Ltd.</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2011</td>
</tr>
<tr>
<td>Country</td>
<td>Japan</td>
</tr>
<tr>
<td>Electric System</td>
<td>600V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>65 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>169.5 t (Train configuration: 2M4T)</td>
</tr>
</tbody>
</table>

1600 Series

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Hitachi, Kawasaki Heavy Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Tokyo Metro Co., Ltd.</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2011</td>
</tr>
<tr>
<td>Country</td>
<td>Japan</td>
</tr>
<tr>
<td>Electric System</td>
<td>1500V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1500 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>100 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>299.8 t (Train configuration 4M6T)</td>
</tr>
</tbody>
</table>

Traction Inverter for 1000 Series

| Output Power (kW) | 120 x 4 |
| Weight (kg)       | 1620 |
| Dimensions (W x D x H mm) | 2600 x 2252 x 670 |
| Cooling Method    | Natural cooling |

Traction Motor for 1000 Series

| Output Power (kW) | 120 |
| Weight (kg)       | 615 |
| Dimensions (Ø x W mm) | 540 x 510 |
| Cooling Method    | Totally-enclosed |

Traction Inverter for 16000 Series

| Output Power (kW) | 205 x 4 |
| Weight (kg)       | 1820 |
| Dimensions (W x D x H mm) | 3200 x 2620 x 700 |
| Cooling Method    | Natural cooling |

Emergency Battery for 1000 Series

| Output Power (kW) | 22 |
| Weight (kg)       | 645 |
| Dimensions (Ø x W mm) | 2000 x 760 x 610 |
| Cooling Method    | Self-cooling |
Electric Equipment for Busan Metro Line 1, Korea

Traction system using permanent magnet synchronous motors (PMSMs) have entered service on the Metro Line 1, operated by the Busan Transportation Corporation in the southeastern Korean city of Busan. PMSM and other key components in the traction inverters used to control the PMSM system, were delivered to Hyundai Rotem Company, the car manufacturer, via Woojin Industrial System Co., Ltd. With this system, the trains are able to achieve a reduction of power consumption of over 30% compared to conventional traction systems.

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Hyundai Rotem Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Busan Transportation Corporation</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2018</td>
</tr>
<tr>
<td>Country</td>
<td>Korea</td>
</tr>
<tr>
<td>Electric System</td>
<td>1500 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>80 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>2501/444T</td>
</tr>
</tbody>
</table>

PMSM Traction Inverter

- Manufactured with Woojin Industrial System Co., Ltd.
- Output Power (kW): 150 x 4
- Weight (kg): 660
- Dimensions (W x D x H mm): 2080 x 730 x 695
- Cooling Method: Natural cooling

PMSM Traction Motor

- Output Power (kW): 140
- Weight (kg): 625
- Dimensions (Ø x W mm): 540 x 515
- Cooling Method: Totally-enclosed

Electric Equipment for Tobu Railway Co., Ltd. 500 Series, Japan

Toshiba supplied PMSM traction system for Tobu 500 Series.

Regenerative energy of the PMSM main circuit system is used to improve the train operation performance throughout the line. This allows also the train to run on sections with step gradient in mountain areas.

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Kawasaki Heavy Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Tobu Railway Co., Ltd.</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2017</td>
</tr>
<tr>
<td>Country</td>
<td>Japan</td>
</tr>
<tr>
<td>Electric System</td>
<td>1500V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1067 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>120 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>119.7t/244T</td>
</tr>
</tbody>
</table>

PMSM Traction Inverter

- Output Power (kW): 190 x 4
- Weight (kg): 620
- Dimensions (W x D x H mm): 1980 x 1103.4 x 700
- Cooling Method: Natural cooling

PMSM Traction Motor

- Output Power (kW): 190
- Weight (kg): 637
- Dimensions (Ø x W mm): 540 x 524.5
- Cooling Method: Totally-enclosed
Toshiba supplied PMSM traction system, train information system, and auxiliary power system for 1000 Series commuter cars of Hankyu Railways.

**Commuter Train**

**Vehicle Manufacturer** Hitachi
**Operator** Hankyu Railways
**Start of Supply** 2013
**Country** Japan
**Electric System** 1500 V DC
**Track Gauge** 1435 mm
**Maximum Operating Speed** 115 km/h
**Vehicle Weight** 251.4 t (Train Configuration: 4M4T)

**PMSM System for Hankyu Railways 1000 Series, Japan**

**High-capacity Traction Motor**
- **Output Power** (kW): 190
- **Weight** (kg): 635
- **Dimensions (Ø x W mm)**: 540 x 566.5
- **Cooling Method**: Totally-enclosed (Outer fan cooling)

**4-in-1 Traction Inverter**
- **Output Power (kW)**: 190 x 4
- **Weight (kg)**: 1190
- **Dimensions (W x D x H mm)**: 3750 x 1070 x 700
- **Cooling Method**: Natural cooling

**High Efficiency Traction Motor**
- **Output Power (kW)**: 140
- **Weight (kg)**: 530
- **Dimensions (Ø x W mm)**: 540 x 621.5
- **Cooling Method**: Self-ventilation

**High Efficiency SiC Traction Inverter**
- **Output Power (kW)**: 140 x 4
- **Weight (kg)**: 410
- **Dimensions (W x D x H mm)**: 1750 x 1124 x 690
- **Cooling Method**: Natural cooling

**High Redundancy and Low Noise Auxiliary Power Unit**
- **Output Power (kW)**: 260
- **Weight (kg)**: 2365
- **Dimensions (W x D x H mm)**: 2315 x 2290 x 700
- **Cooling Method**: Natural cooling

---

**Electric Equipment for JR East E235 Series, Japan**

Toshiba supplied East Japan Railway Company electrical equipment comprising of auxiliary power system, traction motor, and traction inverters for the E235 Series Railcars.

**Commuter Train**

**Vehicle Manufacturer** J-TREC (Japan Transport Engineering Company)
**Operator** JR East (East Japan Railway Company)
**Start of Supply** 2015
**Country** Japan
**Electric System** 1500V DC
**Track Gauge** 1067 mm
**Maximum Operating Speed** 120 km/h
**Vehicle Weight** 342 t (Train configuration: 6M4T)

**High Efficiency Traction Motor**
- **Output Power (kW)**: 140
- **Weight (kg)**: 530
- **Dimensions (Ø x W mm)**: 540 x 621.5
- **Cooling Method**: Self-ventilation

**High Efficiency SiC Traction Inverter**
- **Output Power (kW)**: 140 x 4
- **Weight (kg)**: 410
- **Dimensions (W x D x H mm)**: 1750 x 1124 x 690
- **Cooling Method**: Natural cooling

**4-in-1 Traction Inverter**
- **Output Power (kW)**: 190 x 4
- **Weight (kg)**: 1190
- **Dimensions (W x D x H mm)**: 3750 x 1070 x 700
- **Cooling Method**: Natural cooling

**High-capacity Traction Motor**
- **Output Power** (kW): 190
- **Weight** (kg): 635
- **Dimensions (Ø x W mm)**: 540 x 566.5
- **Cooling Method**: Totally-enclosed (Outer fan cooling)

**High Redundancy and Low Noise Auxiliary Power Unit**
- **Output Power (kW)**: 260
- **Weight (kg)**: 2365
- **Dimensions (W x D x H mm)**: 2315 x 2290 x 700
- **Cooling Method**: Natural cooling

---

**Commuter Train**

**Vehicle Manufacturer** Hitachi
**Operator** Hankyu Railways
**Start of Supply** 2013
**Country** Japan
**Electric System** 1500 V DC
**Track Gauge** 1435 mm
**Maximum Operating Speed** 115 km/h
**Vehicle Weight** 251.4 t (Train Configuration: 4M4T)
**Electric Equipment for Nishi-Nippon Railroad Co., Ltd. 3000 Series, Japan**

Toshiba supplied traction system, auxiliary power system, train information system, ATS system, air-conditioning system, and other electric equipment for 60 cars of Nishi-Nippon Railroad Co., Ltd.

**Electric Equipment for Nishi-Nippon Railroad CO., Ltd. 9000 Series, Japan**

Toshiba supplied traction system, master controller, air-conditioning system and ATS (Automatic Train Stop) system for the 9000 Series trains.

Energy savings and low maintenance were achieved through the use of traction converter using SiC (Silicon Carbide) and high-efficiency asynchronous motors installed in the main circuit system.

Traction inverter and auxiliary power unit are mounted in the same unit, which makes the system work on "triple-mode" (1C2M-VVVF, 1C4M-VVVF or CVCF control). Thus, reliability can be achieved in case of failure.

**Electric System**
- 1500 V DC

**Track Gauge**
- 1435 mm

**Maximum Operating Speed**
- 110 km/h

**Vehicle Manufacturer**
- Kawasaki Heavy Industries

**Operator**
- Nishi-Nippon Railroad CO., Ltd

**Start of Supply**
- 2017

**Country**
- Japan

**Commuter/Cruise Train**

**Vehicle Manufacturer**
- Kawasaki Heavy Industries

**Operator**
- Nishi-Nippon Railroad Co., Ltd

**Start of Supply**
- 2006

**Country**
- Japan

**Electric System**
- 1500 V DC

**Track Gauge**
- 1435 mm

**Maximum Operating Speed**
- 100 km/h

**Vehicle Weight**
- 90.7t/ 1M2T

**Commuter Train**

**Vehicle Manufacturer**
- Kawasaki Heavy Industries

**Operator**
- Nishi-Nippon Railroad Co., Ltd

**Start of Supply**
- 2017

**Country**
- Japan

**Electric System**
- 1500 V DC

**Track Gauge**
- 1435 mm

**Maximum Operating Speed**
- 100 km/h

**Vehicle Weight**
- Front car: 26-28 t, Middle cars: 35 t, (3 train configurations: Mc-Tc, Tc1-M-Tc2, Tc1-M1-T-M2-Tc2)

**Traction Motor**

**Output Power (kW)**
- 175 x 4

**Weight (kg)**
- 650

**Dimensions (Ø x W mm)**
- 540 x 682

**Cooling Method**
- Totally-enclosed (Outer fan cooling)

**Vehicle Manufacturer**
- Kawasaki Heavy Industries

**Operator**
- Nishi-Nippon Railroad CO., Ltd

**Start of Supply**
- 2017

**Country**
- Japan

**Electric System**
- 1500 V DC

**Track Gauge**
- 1435 mm

**Maximum Operating Speed**
- 110 km/h

**Vehicle Weight**
- 60.6t/ 1M1T 90.7T/ 1M2T

**Traction Motor**

**Output Power (kW)**
- 175

**Weight (kg)**
- 650

**Dimensions (Ø x W mm)**
- 420 x 618

**Cooling Method**
- Totally-enclosed (Outer fan cooling)
Electric Equipment for Tokyu Corporation 7500 • 7550 Series, Japan

In 2012, Toshiba supplied traction motors and combined power conversion units to J-TREC for their 7500 Series power car and 7550 Series inspection car.

<table>
<thead>
<tr>
<th>7550 Series</th>
<th>7500 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Manufacturer</td>
<td>J-TREC (Tokyu Sharyo)</td>
</tr>
<tr>
<td>Operator</td>
<td>Tokyo Corporation</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2012</td>
</tr>
<tr>
<td>Country</td>
<td>Japan</td>
</tr>
<tr>
<td>Electric System</td>
<td>1500 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1067 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>110 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>7500 Series: 36.1 t, 7550 Series: 37.7 t</td>
</tr>
</tbody>
</table>

Combined Power Conversion Unit with Standby Redundancy Mode

- **Output Power (kW):** 190 x 4
- **Static Inverter Capacity (kVA):** 80
- **Weight (kg):** 1135
- **Dimensions (W x D x H mm):** 3350 x 1150 x 700
- **Cooling Method:** Natural cooling

High-capacity Traction Motor

- **Output Power (kW):** 190
- **Weight (kg):** 690
- **Dimensions (Ø x W mm):** 610 x 637.5
- **Cooling Method:** Totally-enclosed (Outer fan cooling)

Electric Equipment for Tianjin Binhai Mass Transit Tianjin Binhai Line, China

In 2003, Toshiba supplied traction system, auxiliary power system, train information system for Tianjin Binhai Mass Transit’s Tianjin Binhai Line.

<table>
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<tr>
<th>Vehicle Manufacturer</th>
<th>CNR-Changchun Railway Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Tianjin Binhai Mass Transit</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2003</td>
</tr>
<tr>
<td>Country</td>
<td>China</td>
</tr>
<tr>
<td>Electric System</td>
<td>1500 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>100 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>146.2 (Mc-car: 39.7, T-car: 33.4, Train configuration: 2Mc2T)</td>
</tr>
</tbody>
</table>

- **Output Power (kW):** 200 x 4
- **Weight (kg):** 1050
- **Dimensions (W x D x H mm):** 4200 x 1145 x 650
- **Cooling Method:** Natural cooling

Line Breaker Equipped Traction Inverter

- **Output Power (kW):** 200
- **Weight (kg):** 670
- **Dimensions (Ø x W mm):** 540 x 637
- **Cooling Method:** Self-ventilation

- **Output Power (kW):** 140
- **Weight (kg):** 1630
- **Dimensions (Ø x W mm):** 350 x 850 x 650
- **Cooling Method:** Natural cooling

Voltage Divider Type Auxiliary Power Unit
Electric Equipment for CENTRAL 3000 Series, Brazil

Starting 2011, Toshiba has been supplying Rio de Janeiro State Company of Engineering of Transport and Logistics of Brazil with electric equipment (traction inverters, traction motors, auxiliary power systems, and train information systems) for their 3000 Series cars. In total, electric equipment for 400 cars will be supplied.

<table>
<thead>
<tr>
<th>Traction Inverter</th>
<th>High-capacity Traction Motor</th>
<th>2 Level Auxiliary Power Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power (kW)</td>
<td>210 x 4</td>
<td>206</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>1400</td>
<td>2550</td>
</tr>
<tr>
<td>Dimensions (W x D x H mm)</td>
<td>2900 x 1500 x 650</td>
<td>3100 x 1650 x 650</td>
</tr>
<tr>
<td>Cooling Method</td>
<td>Forced air cooling</td>
<td>Forced air cooling</td>
</tr>
</tbody>
</table>

Toshiba provided a railway system comprising of traction system, auxiliary power system, train information system and air conditioning system to Instituto Ferrocarriles del Estado for Venezuela Railways in 2014. Among these systems, Toshiba provided traction converters, traction motors, and auxiliary power supplies to 52 cars.

Electric Equipment for Caracas Suburban Railway, Venezuela

Toshiba provided a railway system comprising of traction system, auxiliary power system, train information system and air conditioning system to Instituto Ferrocarriles del Estado for Venezuela Railways in 2014. Among these systems, Toshiba provided traction converters, traction motors, and auxiliary power supplies to 52 cars.

<table>
<thead>
<tr>
<th>Traction Inverter for Caracas</th>
<th>Traction Motor for Caracas</th>
<th>Auxiliary Power Unit for Caracas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power (kW)</td>
<td>240 x 4</td>
<td>110</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>2900</td>
<td>1390</td>
</tr>
<tr>
<td>Dimensions (Ø x W mm)</td>
<td>3980 x 2760 x 700</td>
<td>3050 x 1100 x 700</td>
</tr>
<tr>
<td>Cooling Method</td>
<td>Natural cooling</td>
<td>Forced ventilation</td>
</tr>
</tbody>
</table>

| Electric System | 25 kV AC | 3000 V DC |
| Track Gauge     | 1435 mm  | 1600 mm   |
| Maximum Operating Speed | 100 km/h | 100 km/h |
| Vehicle Weight  | 186 (Tc-car: 44.1, M-car: 49.1, Train configuration: 2M2T) | 186 (Tc-car: 44.1, M-car: 49.1, Train configuration: 2M2T) |
Toshiba and JR West developed a new small hybrid propulsion system to fit the luxury sleeper train design. This system uses electricity from a diesel generator and traction battery system.

The traction converters can be installed on the roof of the train, thanks to its compacted design using water cooling system. Traction motor is also totally enclosed, which allows bearing replacement without disassembling it, thereby minimizing maintenance requirements and noise.

**Electric Equipment for JR West TWILIGHT EXPRESS MIZUKAZE, Japan**

<table>
<thead>
<tr>
<th>Electric Equipment</th>
<th>Toshiba provided electric equipment consisting of</th>
<th>Main Transformer</th>
<th>Traction Converter Inverter</th>
<th>Compact Traction Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle Manufacturer</strong></td>
<td>Kinki Sharyo/Kawasaki Heavy Industries</td>
<td><strong>Output Power (kW)</strong></td>
<td>1980</td>
<td><strong>Output Power (kW)</strong></td>
</tr>
<tr>
<td><strong>Operator</strong></td>
<td>JR West (West Japan Railway Company)</td>
<td><strong>Weight (kg)</strong></td>
<td>3450</td>
<td><strong>Weight (kg)</strong></td>
</tr>
<tr>
<td><strong>Start of Supply</strong></td>
<td>2017</td>
<td><strong>Dimensions (W x D x H mm)</strong></td>
<td>3175 x 2325 x 720</td>
<td><strong>Dimensions (Ø x W mm)</strong></td>
</tr>
<tr>
<td><strong>Country</strong></td>
<td>Japan</td>
<td><strong>Cooling Method</strong></td>
<td>Forced oil cooling</td>
<td><strong>Cooling Method</strong></td>
</tr>
<tr>
<td><strong>Electric System</strong></td>
<td>Diesel Electric Hybrid (600 V DC)</td>
<td><strong>Vehicle Weight</strong></td>
<td>485.8 t/484 T</td>
<td><strong>Vehicle Weight</strong></td>
</tr>
<tr>
<td><strong>Track Gauge</strong></td>
<td>1067 mm</td>
<td></td>
<td></td>
<td><strong>Dimensions (Ø x W mm)</strong></td>
</tr>
<tr>
<td><strong>Maximum Operating Speed</strong></td>
<td>110 km/h</td>
<td></td>
<td></td>
<td><strong>Cooling Method</strong></td>
</tr>
</tbody>
</table>

**Electric Equipment for Taiwan Railway Administration EMU800 & TEMU2000, Taiwan**

Toshiba provided electric equipment consisting of main transformer, traction converter inverter, traction motor, auxiliary power supply, and train information system to Taiwan Railway Administration for 296 cars of EMU800 series train and 136 cars of TEMU2000 series.

<table>
<thead>
<tr>
<th>Electric Equipment</th>
<th>Toshiba provided electric equipment consisting of</th>
<th>Main Transformer</th>
<th>Traction Converter Inverter</th>
<th>Compact Traction Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle Manufacturer</strong></td>
<td>Nippon Sharyo/Taiwan Rolling Stock</td>
<td><strong>Output Power (kW)</strong></td>
<td>200 x 4</td>
<td><strong>Output Power (kW)</strong></td>
</tr>
<tr>
<td><strong>Operator</strong></td>
<td>Taiwan Railway Administration</td>
<td><strong>Weight (kg)</strong></td>
<td>1280</td>
<td><strong>Weight (kg)</strong></td>
</tr>
<tr>
<td><strong>Start of Supply</strong></td>
<td>2013</td>
<td><strong>Dimensions (Ø x W mm)</strong></td>
<td>4200 x 794 x 770</td>
<td><strong>Dimensions (Ø x W mm)</strong></td>
</tr>
<tr>
<td><strong>Country</strong></td>
<td>Taiwan</td>
<td><strong>Cooling Method</strong></td>
<td>Natural cooling</td>
<td><strong>Cooling Method</strong></td>
</tr>
<tr>
<td><strong>Electric System</strong></td>
<td>25,000 V AC – 60 Hz</td>
<td></td>
<td></td>
<td><strong>Cooling Method</strong></td>
</tr>
<tr>
<td><strong>Track Gauge</strong></td>
<td>1067 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Operating Speed</strong></td>
<td>140 km/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle Weight</strong></td>
<td>332 t</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Toshiba supplied a traction system for East Japan Railway Company’s flagship cruise train.

The system is bi-mode (electric and diesel) and multi-tension (1500 V DC, 20kV AC 50Hz-60Hz, 25 kV AC 50Hz). Therefore, it is able to run on both various electrified tracks and non-electrified sections.

**Vehicle Manufacturer**: Kawasaki Heavy Industries/ J-TREC (Japan Transport Engineering Company)

**Operator**: JR East (East Japan Railway Company)

**Start of Supply**: 2007

**Country**: Japan

**Electric System**
- 1500 V DC
- 20,000 V AC – 50Hz/60Hz
- 25,000 V AC – 50Hz

**Track Gauge**: 1067 mm

**Maximum Operating Speed**: 110 km/h

**Vehicle Weight/Train configuration**: 536.7 t/ 6M4T

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**High Speed Rail System for Taiwan High Speed Rail Corporation 700T Series, Taiwan**

This is Toshiba’s pioneer high-speed rail overseas project. Starting 2004, Toshiba supplied Taiwan High Speed Rail Corporation with a high-speed rail system (traction system, auxiliary power system, train information system, air-conditioning system, and etc.) as a turn-key contractor for 360 cars.

**Vehicle Manufacturer**: Kawasaki Heavy Industries/ Nippon Sharyo/Hitachi

**Operator**: Taiwan High Speed Rail Corporation

**Start of Supply**: 2007

**Country**: Taiwan

**Electric System**: 25,000 V AC – 60 Hz

**Track Gauge**: 1435 mm

**Maximum Operating Speed**: 300 km/h

**Vehicle Weight**: 503 t

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**Traction Converter Inverter**

- **Output Power (kW)**: 143.5 x 4
- **Weight (kg)**: 1670
- **Dimensions (W x D x H mm)**: 2750 x 2490 x 690
- **Cooling Method**: Natural cooling

**Compact, Light-weight Traction Motor**

- **Output Power (kW)**: 285
- **Weight (kg)**: 1675
- **Dimensions (Ø x W mm)**: 3200 x 2300 x 640
- **Cooling Method**: Forced air cooling

**Light-weight Auxiliary Power Unit**

- **Capacity**: DC: 36kW AC: 5 kVA
- **Weight (kg)**: 645
- **Dimensions (W x D x H mm)**: 2400 x 850 x 640
- **Cooling Method**: Natural cooling
Toshiba developed together with JR Freight the EH800 series locomotive. Seamless run is possible on shared Shinkansen tracks (AC25kV) as well as on standard tracks (AC20kV).

Vehicle Manufacturer | Toshiba
Operator | Japan Freight Railway Company
Start of Supply | 2010
Country | Japan
Electric System | Diesel Electric Hybrid (750 V DC)
Track Gauge | 1067 mm
Maximum Operating Speed | 120 km/h
Vehicle Weight | 68.0 t

In the event of a failure of one traction converter inverter, the remaining one can still provide power to the locomotive.

Class EH800 Electric Locomotive for Japan Freight Railway Co., Japan

Two traction converter inverter are installed on the locomotive, each of them controlling two traction motors. In the event of a failure of one traction converter inverter, the remaining one can still provide power to the locomotive.
Electric Equipment for Locomotives of China Railway Corporation, China

Dalian Toshiba Locomotive Electric Equipment Co., Ltd (DTL), a joint company by Toshiba and CRRC DALIAN, supplied power converters, traction motors, and transformers to China Railway Corporation for their HXD3, HXD3A, HXD3C, and HXD3D Series locomotive cars.

There are more than 2000 cars currently in service, including the HXD3D Series produced by CRRC DALIAN shown in the photo above.

<table>
<thead>
<tr>
<th>Power Converter for HXD3D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Power Unit (MPU)</td>
</tr>
<tr>
<td>Output Power (kW)</td>
</tr>
<tr>
<td>Capacity (kVA)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Dimensions (W x D x H mm)</td>
</tr>
<tr>
<td>Cooling Method</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Light-weight, Membrane Coupling type Traction Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power (kW)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Dimensions (Ø x W mm)</td>
</tr>
<tr>
<td>Cooling Method</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (kVA)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Dimensions (W x D x H mm)</td>
</tr>
<tr>
<td>Cooling Method</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Converter</th>
</tr>
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<tbody>
<tr>
<td>Main Power Unit (MPU)</td>
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<tr>
<td>Capacity (kVA)</td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td>Dimensions (W x D x H mm)</td>
</tr>
<tr>
<td>Cooling Method</td>
</tr>
</tbody>
</table>
Electric Equipment for Korail Class 8500 Electric Locomotive, Korea

Korea Railroad Corporation (Korail) has replaced its older electric locomotives with the new 8500 Series. Toshiba supplied major equipment for the new locomotives, including the main transformers, power converters, traction motors, wheel sets, and cooling blowers.

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Hyundai Rotem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Korail</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2011</td>
</tr>
<tr>
<td>Country</td>
<td>Korea</td>
</tr>
<tr>
<td>Electric System</td>
<td>25,000 V AC – 60 Hz</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>150 km/h</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>132 t (22 t/axle)</td>
</tr>
</tbody>
</table>

Electric Equipment for Minneapolis Metropolitan Council Blue (Hiawatha) Line, USA

In 2004, Toshiba supplied Minneapolis Metropolitan Council with low floor type B (roof-mounted) Combined Power Conversion Unit (C-PCU) and traction motors for 27 vehicles.

<table>
<thead>
<tr>
<th>Vehicle Manufacturer</th>
<th>Bombardier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>Minneapolis Metropolitan Council</td>
</tr>
<tr>
<td>Start of Supply</td>
<td>2004</td>
</tr>
<tr>
<td>Country</td>
<td>USA</td>
</tr>
<tr>
<td>Electric System</td>
<td>750 V DC</td>
</tr>
<tr>
<td>Track Gauge</td>
<td>1435 mm</td>
</tr>
<tr>
<td>Maximum Operating Speed</td>
<td>89 km/h (55 mph)</td>
</tr>
<tr>
<td>Vehicle Weight</td>
<td>105 ton (220,000 lbs)</td>
</tr>
</tbody>
</table>

### Power Converter

- Main Power Unit (MPU) Output Power (kW): 1150 x 3
- Auxiliary Power Unit (APU) Capacity (kVA): 230
- Weight (kg): 3550 + coolant (200)
- Dimensions (W x D x H mm): 4000 x 1020 x 2050
- Cooling Method: Water cooling

### Traction Motor

- Dimensions (φ x W mm): 800 x 800
- Output Power (kW): 1150
- Weight (kg): 2150
- Cooling Method: Forced air cooling

### Compact and Light-weight Traction Inverter

- Output Power (kW): 140 x 2
- Auxiliary Power Unit Capacity (kVA): 30
- Weight (kg): 685
- Dimensions (W x D x H mm): 1600 x 1800 x 500
- Cooling Method: Forced air cooling

### Traction Motor

- Output Power (kW): 140
- Weight (kg): 470
- Dimensions (W x D x H mm): 470 x 654
- Cooling Method: Totally-enclosed (Outer fan cooling)