Toshiba’s transportation system technology is widely-used all over the world.

Toshiba Locomotives

Find out more about Toshiba transportation solutions on [http://toshira-railway.com](http://toshira-railway.com)
Toshiba Locomotives: Aiming to Meet Your Needs

**High Availability with Water-Cooled Power Converter**

Independent control is applied for high availability and performance.

**Low-emission Transformer**

Nitrogen gas sealed transformer technology reduces need for insulation oil exchange.

**Efficient Traction Motor**

PMSM (Permanent Magnet Synchronous Motor) technology realizes high efficiency of up to 97%.*

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**Hybrid Locomotive**

- **Specifications**
  - Locomotive Total Output: 700 kW
  - 800 kW
  - 230 kW
- **Length**: 120 km/h
- **Weight**: 80 – 100 tons
- **Bogie Arrangement**: Co-Co
- **Maximum speed**: 120 km/h

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**DieSEL Electric Locomotive**

- **Specifications**
  - DEL145
  - DEL151
- **Maximum Power**
  - (Engine Output): 4,500 HP
  - 3,500 HP
- **Gauge**: Standard
- **Standard / Narrow**
- **Weight**: 120 – 150 tons
- **Bogie Arrangement**: Co-Co
- **Maximum speed**: 120 km/h

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**Toshiba’s lithium-ion battery realizes safety, long life and good performance, even in low-temperature environments.**

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*The efficiency of PMSM was calculated with load measurement based on IEC 60349-2 at the temperature below 40°C from 8/25/2009 to 9/25/2009.*
**History**

**Toshiba’s first electric locomotive**

Toshiba’ s glorious locomotive business began with supplying electric components for the 40-ton electric locomotive built by Ishikawajima Shipbuilding & Engineering Co in 1923. The first locomotive Toshiba manufactured was the 73-ton locomotive in 1926. This locomotive was used for coal transportation. Since then, Toshiba has supplied 600 complete locomotives or electric components for locomotives for Japanese customers.

**Overseas business in early times**

Toshiba locomotive business has entered into the global market by supplying electric locomotives to Indian Railways. This was followed by supplying 5 electric locomotives to New Zealand in 1968. Since then, more than 2,000 locomotives or their components had been supplied to customers outside Japan.

**Diesel electric locomotive**

Toshiba’ s first diesel electric locomotive was built in 1934, equipping a 750 HP diesel engine. Since 1969, Toshiba had manufactured 26 locomotives (500 HP/1050 HP) for Zambia and Brazil. Since 1981, 24 locomotives with two 500 HP engines had been shipped to New Zealand. In 1987, 24 locomotives with 2400 HP were delivered to Malaysia in collaboration with Kawasaki Heavy Industry, ltd. The locomotives for steelworks with radio remote control were manufactured in 1991 and some were delivered to various locations in Japan.

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**Key Technologies for Locomotives**

**Power Converters**

Modular design power converter cubicle for locomotive – The optimum configuration can be realized.

- Main Power Unit up to 1,400 kW and convertible to APU (up to 500 kVA)
- Auxiliary Power Unit (230 kVA)
- Cooling Unit

3-MPU (1,400 kW), 1-APU (230 kVA) configuration

**Other existing IGBT power converters**

Power Converters for Electric Locomotives – Wide range of tractive power can be covered.

- 500 kW / axle
- 750 kW / axle
- 1,400 kW / axle

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- Toshiba supplied electrical equipment for diesel electric locomotive
- Maximum speed: 120 km/h
- Locomotive weight: 100 tons
- Axle arrangement: Bo-Bo
- Engine power: 2,580 kW
- Number of locomotives: 20
- Application: Freight (coal)

- Toshiba supplied electrical equipment for diesel electric locomotive
- Maximum speed: 90 km/h
- Locomotive weight: 180 tons
- Axle arrangement: Co-Co
- Engine power: 44+32
- Number of locomotives: 110
- Application: Freight (heavy ion)

- Toshiba supplied electrical equipment for diesel electric locomotive
- Maximum speed: 45 km/h
- Locomotive weight: 60 tons
- Axle arrangement: Bo-Bo
- Engine power: 2,180 kW
- Number of locomotives: 31
- Application: Shunting
Diesel Electric Locomotive

Overseas business in early times

History

Toshiba’s first diesel electric locomotive was built in 1934, equipping a 750 HP diesel engine. Since 1969, Toshiba has supplied electric components for locomotives for Japanese customers. Since then, Toshiba has supplied 600 complete locomotives or their components had been supplied to customers outside Japan.

This was followed by supplying 5 electric locomotives to New Zealand in 1968. Since then, more than 2,000 locomotives or their components had been supplied to customers outside Japan.

In 1987, 24 locomotives with 2400 HP were delivered to Malaysia in 1987. Toshiba locomotive business has entered into the global market by supplying electric locomotives to Indian Railways.

Recent Products

PMSM (Permanent Magnet Synchronous Motor)

PMSM technology with reduced energy loss realizes high efficiency up to 97%.* This high efficiency also realizes smaller size or higher power compared with our conventional products.

* The efficiency of PMSM was calculated with loss measurement based on IEC 60349-2 at the temperature below 40˚C from 8/25/2009 to 9/25/2009.

AC Induction Motor

| 500 kW class | 750 kW class | 1,400 kW Class |

Main Transformers

Catenary Voltage: 20 kVac Catenary Voltage: 25 kVac Catenary Voltage: 50 kVac

Main Battery

SCiB™ anode material LTO (Lithium Titanate Oxide) makes the battery good performance, versatility and durability.

PMSM in Toshiba’s locomotives

Main Alternator

Main alternator for diesel electric locomotive

TCMS

Distribution of Powering/Regenerative braking command to other locomotives in the same train set with wired/wireless communication.

Driving screen examples

Wireless Communication

Other existing IGBT power converters

- 2-MPU (1,400 kW), 1-APU (500 kVA)
- 2-MPU (1,400 kW)

Cooling Unit

Auxiliary Power Unit (230 kVA)

Application:

- Transformers
- Main Battery
- Main Alternator
- TCMS

Electric Locomotive

Application: Freight
Number of locomotives: 1,090
Catenary: 25k Vac/50 Hz
Rated power: 7,200 kW (continuous) at tread Axle arrangement: Co-Co Locomotive weight: 338 tons, 150 tons Maximum speed: 120 km/h Toshiba supplied electrical equipment

Diesel Electric Locomotive

Application: Freight
Number of locomotives: 444-32 Catenary: 50k Vac/50 Hz Rated power: 4,500 kW (continuous) at tread Axle arrangement: Co-Co Locomotive weight: 180 tons Maximum speed: 90 km/h Manufactured in collaboration with a local locomotive builder

Hybrid Locomotive

Application: Shunting
Number of locomotives: 31 Maximum power: 500 kW at tread Axle arrangement: Bo-Bo Locomotive weight: 60 tons Maximum speed: 45 km/h Toshiba supplied electrical equipment

Recent Products

Class 2E Electric Locomotive (Transnet, Republic of South Africa)

Class 2E Electric Locomotive, (Transnet, Republic of South Africa)

Class 29 Diesel Electric Locomotive (Ministry of Railways, China)

Class 19E Electric Locomotive

Class 15E Electric Locomotive

HD300 Hybrid Locomotive (KTMB Malaysia)

HXD 3 Electric Locomotive (Ministry of Railways, China)