

Hong Kong Subway Systems, West Island Line

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Abstract

The West Island Line is one of the three new subway lines currently being constructed by Hong Kong Mass Transit Railway Co., Ltd. (MTRCL). This line started its business on December 28, 2014. The starting point of this line is located at Sheung Wan station, the end point of the existing Island Line. The line combines three stations, Sai Ying Pun Station, Hong Kong University Station, and Kennedy Town Station. The total distance of the line is approximately 3km. For this construction project, we supplied incoming substation facilities, traction power facilities, and power distribution facilities. These power supply facilities service three project sites.

1 Preface

Hong Kong Mass Transit Railway Co., Ltd. (MTRCL) is a railway company that manages a total of 7 MTR lines in Hong Kong Island, the Kowloon Area, and also 4 lines for train operation in the New Territories.

For the construction project of the West Island Line that we started it in 2009, the starting point is at Sheung Wan Station which is the end point of the existing Island Line. It was extended westward as far as three stations, Sai Ying Pun Station, Hong Kong University Station, and Kennedy Town Station. It takes eight minutes to go from the terminal station to the opposite terminal station. The route is located completely underground. In the past, traveling by bus took 15 to 25 minutes. After the start of the new line, traveling time for commuters and students has been greatly reduced.

2 Outline of Power Supply Facilities

Power supply facilities of Hong Kong MTR receive electric power from Hong Kong Electric Company (HEC) and China Light & Power Company (CLP) through a 33kV power transmission line. The received power is distributed to traction substations and station substations in the loop distribution network. Each traction substation rectifies AC power into 1500V DC, and further feeds the rectified power to trains. The AC power is also stepped down to

400V to secure power supplies for various facilities in the station buildings.

2.1 33kV AC Power Network

Fig. 1 shows a 33kV loop power network. Electric power is distributed to traction stations (KET and HKU substations) and a station substation (SYP substation) from a 33kV loop distribution network. Since loop distribution cables among the respective substations are protected by pilot wire relays, a faulty section never influences other healthy sections. 33kV busbars and station transformers at the respective substations are arranged into a redundant configuration so that the power supply for station facilities is never lost even in the event a fault occurs in a single unit.

2.2 1500V DC Traction Network

Fig. 2 shows the 1500V DC traction network. Each traction substation is equipped with a rectifier unit. In addition to direct acting high-speed circuit-breakers, the DC switchgear is equipped with multi-functional protective relays having the functions of fault current waveform recording and event logging so that the switchgear can take adequate measures against various faults. The rail side is provided with Over Voltage Protection Devices (OVPD) in order to detect overvoltages that are generated between rails and ground at the time of train power running and power regeneration caused by dynamic braking. When an overvoltage is detected, rails are

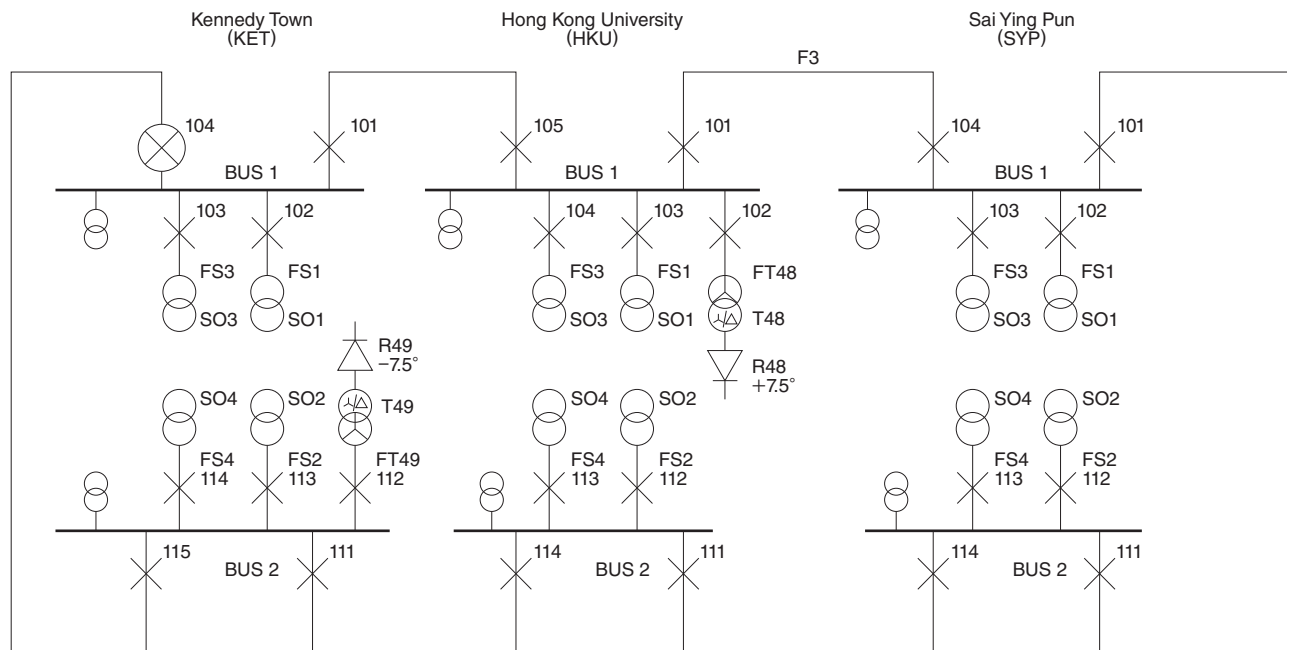


Fig. 1 33kV Loop Power Network

The 33kV loop network of the West Island Line is shown.

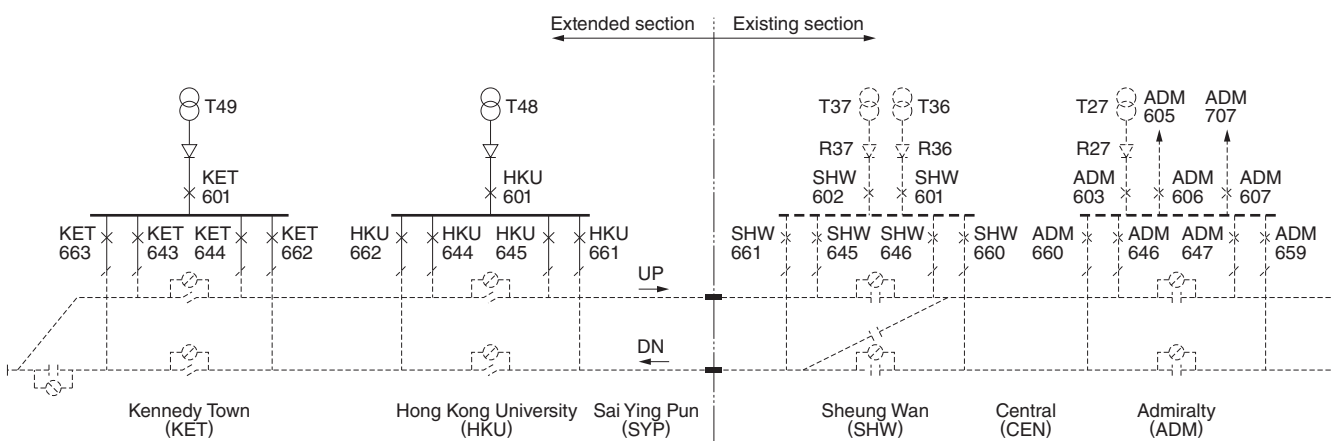


Fig. 2 1500V Traction DC Network

The 1500V traction network of the West Island Line is shown.

forcibly grounded so that passengers on the platform do not get electric shocks.

3 Specifications of Power Supply Facilities

3.1 33kV Gas Insulated Switchgear (GIS)

Specifications the 33kV GIS are listed below.

- (1) Standard: IEC60298
- (2) Type: Indoor GIS
- (3) Ratings

Rated voltage: 36kV

Rated breaking current: 25kA

Rated current: 2000/1250A

3.2 Rectifier Transformer

The rectifier transformer is of the oil-immersed self-cooled type for outdoor use. It is equipped with two windings on low-voltage side arranged for combined 24-phase rectifiers. Ratings of the transformer are specified below.

- (1) Ratings

Rated voltage: 4262kVA

Rated primary voltage: 33kV

Rated secondary voltage: $587V \times 2$

Type of rating: 100% continuous, 150% for 3 hours, 300% for 1 minute, 450% for 15 seconds

3.3 Rectifiers

Rectifiers are of the natural air-cooled type for outdoor use. Each diode device is provided with a diode fuse so that the device can be protected in the case of a fault. The Open Circuit Arm Detection (OCAD) elements are adopted to detect a fault of the diode device itself. Ratings of the rectifiers are specified below.

(1) Ratings

Rated capacity: 4000kW

AC input voltage: $587V \times 2$

DC output voltage: 1500V (at 100% load)

Type of rating: 100% continuous, 150% for 3 hours, 300% for 1 minute, 450% for 15 seconds

3.4 DC Switchgear

Specifications of the DC switchgear are shown below.

(1) Standard: IEC61992

(2) Type: Indoor, DC circuit-breaker panel

(3) Ratings

Rated voltage: 1800V

Rated current: 6000A

4 Postscript

Presently in Hong Kong, construction works for three new routes are in progress toward the goal of commercial operation during the inauguration in 2015 to 2016. Upon the completion of these routes, the convenience of the Hong Kong MTR networks will be greatly improved for citizens and tourists.

Lastly, we would like to express our appreciation and gratitude to all individuals affiliated with this construction project for their precious guidance and kind cooperation.

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