



1991
TRAM SUBSTATIONS

ASEA BROWN BOVERI INDUSTRIAL PTY LIMITED

**A FLEXIBLE SUPPLY
FOR DC TRACTION NETWORKS**

**ABB INDUSTRIAL
- COMMITMENT TO INNOVATION**

OVERVIEW

A DC traction system is usually fed through stationary rectifier substations erected along the track. ABB has in the past, designed and manufactured successfully a number of such substations of various ratings for PTC (The MET) in Melbourne as well as for the State Transport Authority of South Australia {refer Reference List}.

However, special circumstances such as those listed below lead to requirements which can only be fulfilled by a mobile substation: substation which can satisfy the following requirements:

- Feeding a line end that could be moved somewhere else later.
- Feeding a line being subject to long duration works such as:
 - . Installation of a new stationary substation.
 - . Repair, maintenance or modification to an existing stationary substation.
- Temporary back-up in feeding a particular line.
- Operation on sites with different HVAC supply systems (6.6kV, 11kV or 22kV).
- Adaptability to various sites in terms of AC & DC connections (underground and/or overhead).

With the capabilities intrinsic to the group, ABB were well placed to rise to the challenge of designing and manufacturing mobile substations for PTC {Public Transport Corporation, Melbourne}, which have all the design parameters as well as the electrical and mechanical features of a modern substation whilst simultaneously meeting the requirements of flexibility in such applications for DC traction systems.

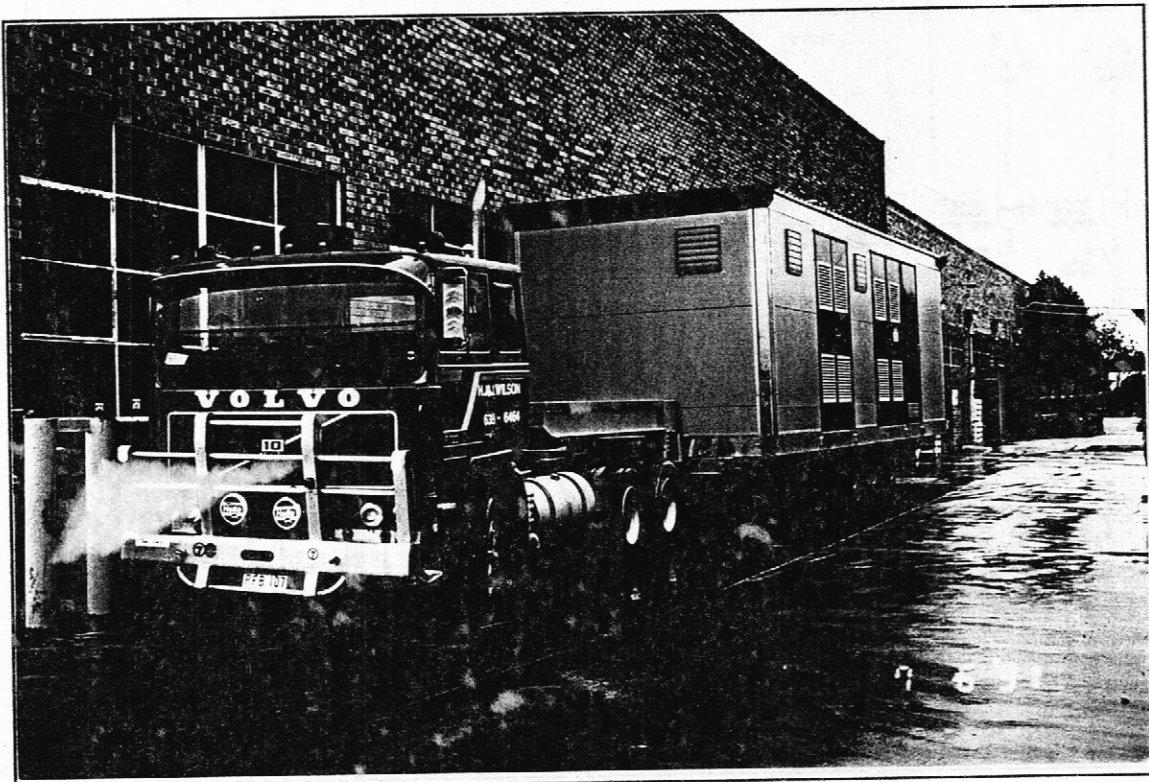


Figure 1 - Complete Substation {ready to roll}

DESCRIPTION

These latest mobile substations, with a high degree of Australian content, serve as a shining example of ABB's strong commitment to local engineering, manufacture and back-up services.

Each of these two mobile substations is mounted on a low loader trailer designed for ease of transport to various sites within the Melbourne metropolitan area and can either be operated whilst on the trailer or demounted.

Each substation comprises the following equipment housed in their respective cubicles, and arranged for optimum functionality {refer Fig. 2 - Single Line Diagram}:

- AC HV switchgear incorporating withdrawable vacuum circuit breaker for protection of the main transformer and rectifier.
- A multi-ratio cast-epoxy resin main transformer equipped with a microprocessor based temperature monitoring device.
- A 6-pulse withdrawable truck mounted silicon diode rectifier including high speed fuses.
- A filter cubicle which includes a smoothing reactor.

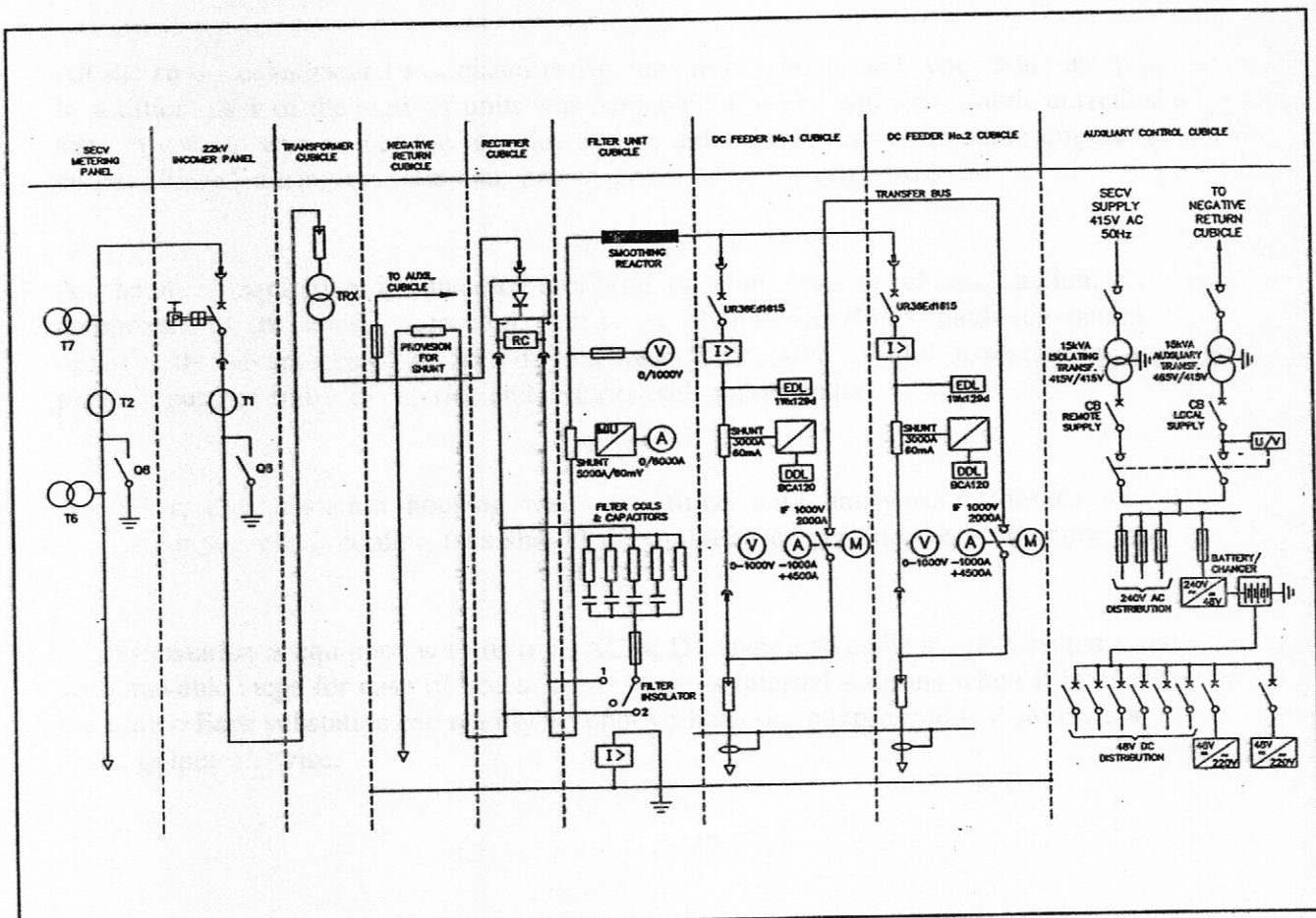


Figure 2 - Single Line Diagram

- An auxiliary control cubicle that includes all the low voltage (240VAC & 48VDC) control equipment as well as facilities for low voltage back-up supply.
- A negative return cubicle which houses heavy interconnection copper busbars between the main transformer and the rectifier.
- A supervisory cubicle incorporating PTC telemetry equipment for remote control of the substation.
- Two (2) DC feeder cubicles comprising each an UR36 withdrawable truck mounted high speed DC circuit breaker equipped with:
 - * A leakage test and auto-reclose device (IWX 1290) for testing and catenary conditions.
 - * A line fault detector (DDL BDA 12o) for remote line fault detection.

Both DC feeders feature electrical interlocks to prevent racking in and out of a closed circuit breaker as well as accidental contact with the 600VDC conductors.

Each feeder cubicle is also fitted with a DC surge arrester for protection against lightning surges, as well as a flexible drive arrangement for manual operation of the transfer switch from the front of the feeder cubicle. The transfer switch enables maintenance to be performed on the feeder truck whilst ensuring continuity of the DC supply.

All the above cubicles and associated equipment were routine and type tested as applicable. In addition, each of the rectifier units was subjected to a very strigent "Diode current sharing test" in order to ensure that the rectifier diodes individually carry the same current {within defined limits} during operation so that no one diode is overly stressed.

All the above equipment is contained in a housing of modular panel construction. The main component of the housing structure consists of bondor-equibond sandwich panels which provides the advantages of reduced overall weight, effective thermal insulation, as well as a pleasant surface finish of interior and exterior substation walls.

Moreover, the substation housing walls are fitted with anti-vermin louvres for natural ventilation as well as cooling fans should the ambient temperature become abnormal.

Each substation is equipped with its own AC & DC overhead cable support systems and with withdrawable steps for ease of access to its various internal sections when it is operated on the trailer. Each substation can readily accept overhead or underground HV supply and deliver a DC output likewise.

TECHNICAL CHARACTERISTICS

Electrical:

Rated Power	1800 kW
Rated Voltage at Full Load	600 VDC
Rated Current	3000 ADC

Mechanical:

Trailer Weight	7.5T
Substation Weight (without trailer)	21.3T

Overall Dimensions:

- Substation (without trailer)
 - Height: 3250
 - Width: 3400mm
 - Length: 10550
- Substation (including trailer)
 - Height: 4300mm
 - Width: 3400mm
 - Length: 14050mm

APPLICATIONS

In any DC traction system such as:

- Tramways
- Trolley Bus
- Suburban Train
- Any DC Rail System

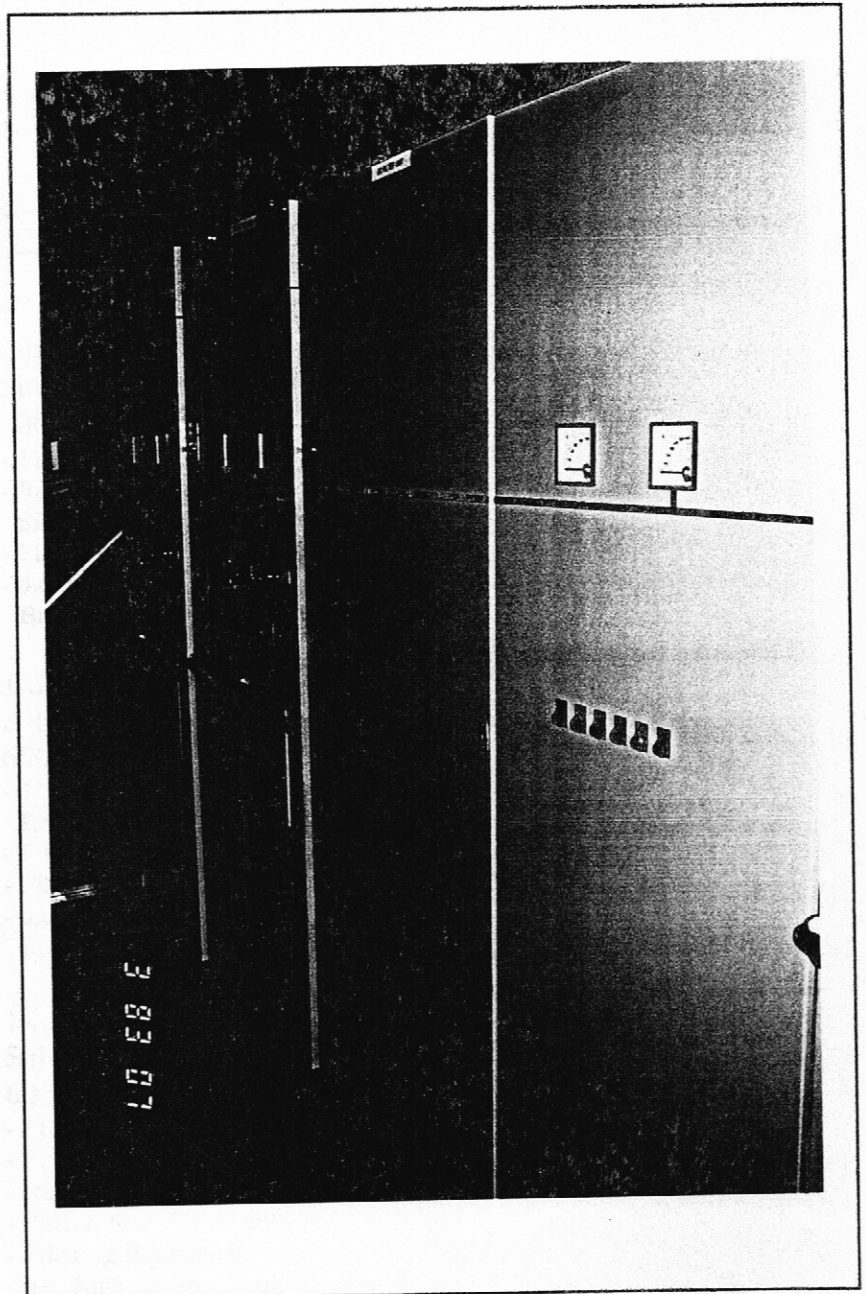


Figure 3 - DC Switchboard

D.C. Traction Power Supply Equipment

<u>END USER</u>	<u>STATE</u>	<u>EQUIPMENT DETAILS</u>	<u>YEAR OF DELIVERY</u>
Metropolitan Transit Authority	VIC	2-off Packaged Rectifier Substations rated 600kW 600V d.c. each comprising: - 11kV Switchgear - Rectifier Transformer - Silicon Rectifier (6 pulse) - Filtering Equipment - d.c. High Speed Circuit Breaker Feeder Panels (2 off)	1984
Metropolitan Transit Authority	VIC	1-off Packaged Rectifier Substation rated 600kW 600V d.c. comprising: - 11kV Switchgear - Rectifier Transformer - Silicon Rectifier (6 pulse) - Filtering Equipment - d.c. High Speed Circuit Breaker Feeder Panels (2 off)	1985
Metropolitan Transit Authority	VIC	1-off Packaged Rectifier Substation rated 600kW 600V d.c. comprising: - 11kV Switchgear - Rectifier Transformer (cast epoxy type) - Silicon Rectifier (6 pulse) - Filtering Equipment - d.c. High Speed Circuit Breaker Feeder Panels (2 off)	1986

D.C. Traction Power Supply Equipment

<u>END USER</u>	<u>STATE</u>	<u>EQUIPMENT DETAILS</u>	<u>YEAR OF DELIVERY</u>
Perisher Skitube	NSW	2-off Sets of Equipment for 2000kW, 1500V d.c. Rectifier Substations each comprising: - 11kV Switchgear - Rectifier Transformer (cast epoxy type) - Silicon Rectifier (12 pulse) - d.c. High Speed Circuit Breaker Feeder Panels (2 off)	1986
State Transport Authority	S.A.	1-off Packaged Rectifier Substation rated 600kW 600V d.c. comprising: - 11kV Switchgear - Rectifier Transformer - Silicon Rectifier (12 pulse) - Filtering Equipment - d.c. High Speed Circuit Breaker Feeder Panels (2 off)	1987
Metropolitan Transit Authority	VIC	Equipment for 600V d.c. Traction Substations comprising: - Silicon Rectifiers rated 1000kW, 6 pulse (4 off) - d.c. High Speed Rectifier Circuit Breaker rated 2600A (4 off) - Filtering Equipment - Rectifier Transformers (4 off cast epoxy type)	1988
Metropolitan Transit Authority	VIC	Equipment for 600V d.c. Traction Substations comprising: - d.c. High Speed Circuit Breaker Feeder Panels rated 2600A (16 off)	1988

D.C. Traction Power Supply Equipment

<u>END USER</u>	<u>STATE</u>	<u>EQUIPMENT DETAILS</u>	<u>YEAR OF DELIVERY</u>
State Transport Authority	S.A.	3-off Packaged Rectifier Substations rated 600kW 600V d.c. each comprising: <ul style="list-style-type: none"> - 11kV Switchgear - Rectifier Transformer - Silicon Rectifier (12 pulse) - Filtering Equipment - d.c. High Speed Circuit Breaker Feeder Panels (2 off) 	1989
Public Transport Corporation	VIC	2-off Mobile Rectifier Substations rated 1800kW 600V d.c. each comprising: <ul style="list-style-type: none"> - MV Switchgear - Rectifier Transformer - Silicon Rectifier - Filtering Equipment - d.c High Speed Circuit Breaker Feeder Panels (2 off) 	1991