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THE MUSEUM SUBSTATION

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Upon the closure of the Brisbane tramway system, the Brisbane City Council gave to the BTMS two identical B.T.H. glass bulb rectifier sets from the Coorparoo and Kedron substations and also D.C. feeder equipment, thus giving us the opportunity to have an authentic rectifier sub-station.

Each set consists of four glass bulbs connected in parallel with a total rating of 750 KW or 1250 amps . Each bulb is housed in a separate cubicle, the four cubicles being mounted side by side and fed from a common set of busbars on top of the cubicles connected to a 6 phase supply from the rectifier transformer. These units were built about 1940.

The transformer is supplied with 11 KV via an oil circuit breaker with solenoid closing. Protection on the 600 volt D.C. side is by means of high speed and slow speed circuit breakers.

The rectifiers were remotely controlled from the Valley substation via supervisory equipment and are designed to operate unattended and starting is fully automatic, also various protective devices are fitted, that is the rectifier will shut down automatically in the case of repeated A.C. overload or leakage to earth in a cubicle, or failure to complete the starting sequence within a set time interval. If a rectifier bulb should overheat, the rectifier will shut down until it cools, then it will automatically come back on line.

We removed the rectifier bulbs from their cubicles and turned them upside down for transport using special crates in which the bulbs had originally been delivered. Unfortunately there was not a sufficient number of crates to store all the bulbs in and some that were not protected in this way were accidentally broken in handling or when in storage.

The two rectifiers were dismantled and lifted onto trucks using the substation cranes which consisted of chain hoists mounted on overhead gantries. This involved also lifting the 7½ ton rectifier transformers, which were situated in deep pits inside the substations.

The 11 KV switchgear used with both these rectifiers was of rather obselescent Reyrolle type, so the switchgear we obtained was from the newer steel tank rectifier set at Coorparoo substation. These oil circuit breakers were in a very small room and had to be dismantled, involving the melting down of compound in cable boxes and disconnecting of busbar connections between the circuit breakers.

A variety of other equipment, such as A.C. and D.C. control panels and D.C. feeder panels, also high speed circuit breakers and other auxiliary equipment were also transported to Ferny Grove.

All this equipment was stored for three years at our old site at Ferny Grove, awaiting decisions on the right of way proposals but had to be moved again to the new site in 1972. On arrival at the new site, refurbishing of rectifier cubicles was commenced, and the substation building forty feet by twenty feet was erected by a building firm. This building has a normal sized door at the depot end and a large sliding door at the other end.

Concrete foundations were provided for the two rectifier transformers which stand on two lengths of eighty pound rail turned upside down and embedded in the concrete, one transformer to be placed in service and the other as a spare.

Inside the substation, concrete foundations were poured for the 11 KV switchgear which was painstakingly assembled and internal control wiring replaced where necessary also the switchgear was prepared for reconnection by melting out compound from cable boxes and busbar chambers. Two of the rectifier cubicles were placed in position. Conduits were laid in the floor to carry A.C. and D.C. control wiring, also closing, tripping and protection circuits and wiring for remote control and indication for possible connection at a later date.

Application was made to the Brisbane City Council Electricity Department for 11 K.V. and also three phase 415 volt supply, and the council agreed to carry out this work at a cost of $3,000 which included also new oil in the rectifier transformer and erection of a number of steel and timber poles for the overhead.

Connection was completed last year by the S.E.Q.E.B., the successor to the B.C.C. at the agreed price, and the 11 KV switchgear tested and passed for service.

Also last year the Q.E.G.B. donated to the museum another glass bulb rectifier set from the former S.E.A. railway at Bulimba which carried coal to the Bulimba power houses, this coal now being transported by river. This is a Hewittic rectifier with three bulbs and D.C. circuit mounted in four cubicles. The glass bulbs in this unit were even larger and more awkward looking than those in the B.T.H. units so, rather than go through the procedure of turning these over this unit was transported to the museum carefully without removing the bulbs from the cubicles and no damage occurred.

This unit will eventually be erected in the substation as a standby unit, but supplied from the present rectifier transformer as its original transformers were 3300 volt and therefore not suited to 11 KV supply.

The Substation Today

Recently two additional rectifier cubicles were erected and AC busbars installed from the transformer to the rectifier. The first rectifier bulb was carefully turned right way up and installed in its cubicle. With great anticipation the control switch was turned on and the bulb found to be operational. A temporary D.C. switchboard was made up using a tramcar line breaker to trip out on minor overloads in series with a trolley bus type hand reset circuit breaker which will operate in the case of a major overload or short circuit.

The substation is now controlled by means of a key operated switch in a box mounted on the outside wall, thus allowing traffic staff to operate the rectifier without entering the building. This switch may be turned off in emergency without the use of the key.

The Substation in the Future

Although the substation is operational it is barely adequate at present and much work remains to be done. So far only one of the four rectifier bulbs that make up the set has been tested and placed in service and this bulb was in daily use from 1942 until 1969; another cubicle will need to be prepared and a second bulb installed to ensure reliability.

Before two or more bulbs can operate together in parallel it will be necessary to instal a high speed circuit breaker in order to cope with prospective fault currents.

To use this breaker the D.C. control panel will need to be installed and this panel has a slow speed circuit breaker mounted on it also, which involves a considerable amount of control wiring. It is hoped that eventually the four bulbs which make up the set will all be in service but this of course depends on how many of the total of five bulbs have retained their vacuum.

The set obtained from Bulimba should be comparatively easy to install and connect to the existing six phase busbars and if this unit proves successful it will help by easing the load on the older unit.

At some time in the future if insufficient bulbs are available for service it would appear to be a fairly simple process to place a bank of silicon diodes in a rectifier cubicle in place of a bulb. The remaining bulb or bulbs could be disconnected but still be used as required to demonstrate this most fascinating means of rectification.