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## THE TYPE Re4/4 LOCOMOTIVE FOR THE PRIVATE RAILWAYS

By M. Hardy-Randall

During the early 1980's several railway companies including the SBB formed a commission, under the auspices of the Swiss Federal Office of Transport to formulate plans for a medium powered locomotive design that could be easily adapted for use on any of the private lines. The result of this meeting can now be seen on the SBB Brünig, FO, BT and SZU lines, but it is with the two latter mentioned lines that this article is concerned.

When the Bodensee Toggenburg Bahn took delivery of six of the new Re4/4's, the locomotive improvement plan of that company was complete for the time being. The Re4/4 locomotives numbered 91 - 96 will be used on the BT passenger express trains from Romanshorn to Luzern over the 5% gradient between Pfäffikon and Arth-Goldau, which has been found to tax the high powered BDe4/4 units to the maximum. The loco type Be4/4 will be placed in reserve until all the new locos have been delivered, at which time three of the Be4/4's will be sold to the SZU, Oswald Steam at Samstagern and the third to Dampfbahn Verein Zürcher Oberland.

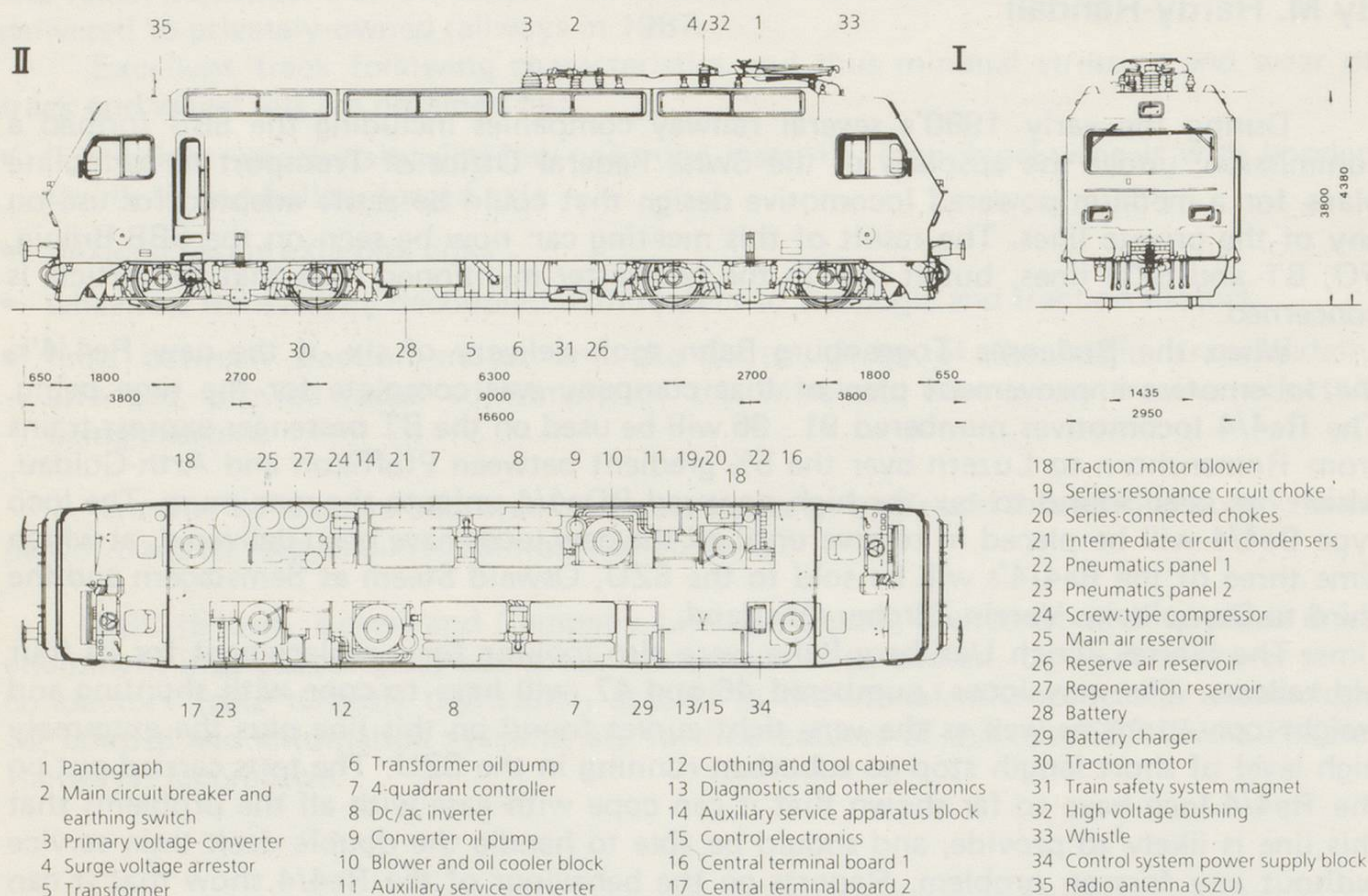
The Sihltal Zürich Uetliberg Bahn were also looking for a replacement for its four old railcars. The new locos, numbered 46 and 47, will have to cope with shunting and freight operations as well as the very tight curves found on this line plus the extremely high level of short length stop-go suburban running in the SZU. The tests carried out on the Re4/4 loco have so far shown that it can cope with ease with all the problems that this line is likely to provide, and should be able to handle the double deck train service without any foreseen problem. Reports on the behaviour of the Re4/4 show that it can handle curved track down to 280 metre radius at speeds up to 95 Km/h. With the building of the connecting line from Zürich Selnau to Zürich Hbf, and the possible extension of the SZU service from Sihlbrugg to Zug more motive power would be required. If the new service is implemented then a further two locos of this type will be required.

### The Locomotives

The Re4/4 locomotive weighs just 69 tonnes, and this is broken down into 31 tonnes of mechanical equipment and 38 tonnes of electrical items. The engine is fitted with a single pantograph which has simplified the roof detail and cuts down on maintenance. The body (9 tonnes) is made up of a 1.5 mm thick corrugated sidewall steel module, developed from the SBB Re4/4 IV, and two drivers cab modules which are welded onto the mainframe. The mainframe itself is made from 5 mm thick steel sheet into two longitudinal box girders with four main transoms to support the body over the bogies and the under floor mounted transformer unit. The 3 roof units which contain the extraction fan equipment for oil coolers and the traction motors can be easily removed to give access to over 90% of the interior. The body is supported on four groups of three closely mounted springs, which extend from either side of each bogies up into the body shell thus giving a more stable ride. The cab is fitted with heated laminated windows of 18 mm thickness in the front and wide double glazed units on the sides and pneumatically operated rear view mirrors. Noise level inside the cab whilst running at 125 Km/h with maximum load is incredibly low at only 70 dB(A). The driving wheelsets are based on a design by SLM/Klöckner which has been proven by an Re4/4 running on the BLS for the



## Re 4/4 All-purpose Converter Locomotive



Outline drawing and layout of equipment.

last 460,000 Kms. The pneumatic equipment is supplied from an Atlas Copco screw type compressor via an auxiliary air drier. All driving wheels are fitted with a mechanical brake and a train operated brake and have two pairs of self adjusting brakeshoes, and each axle is fitted with a parking brake which enables the locomotive to be held stationary on a 5% gradient.

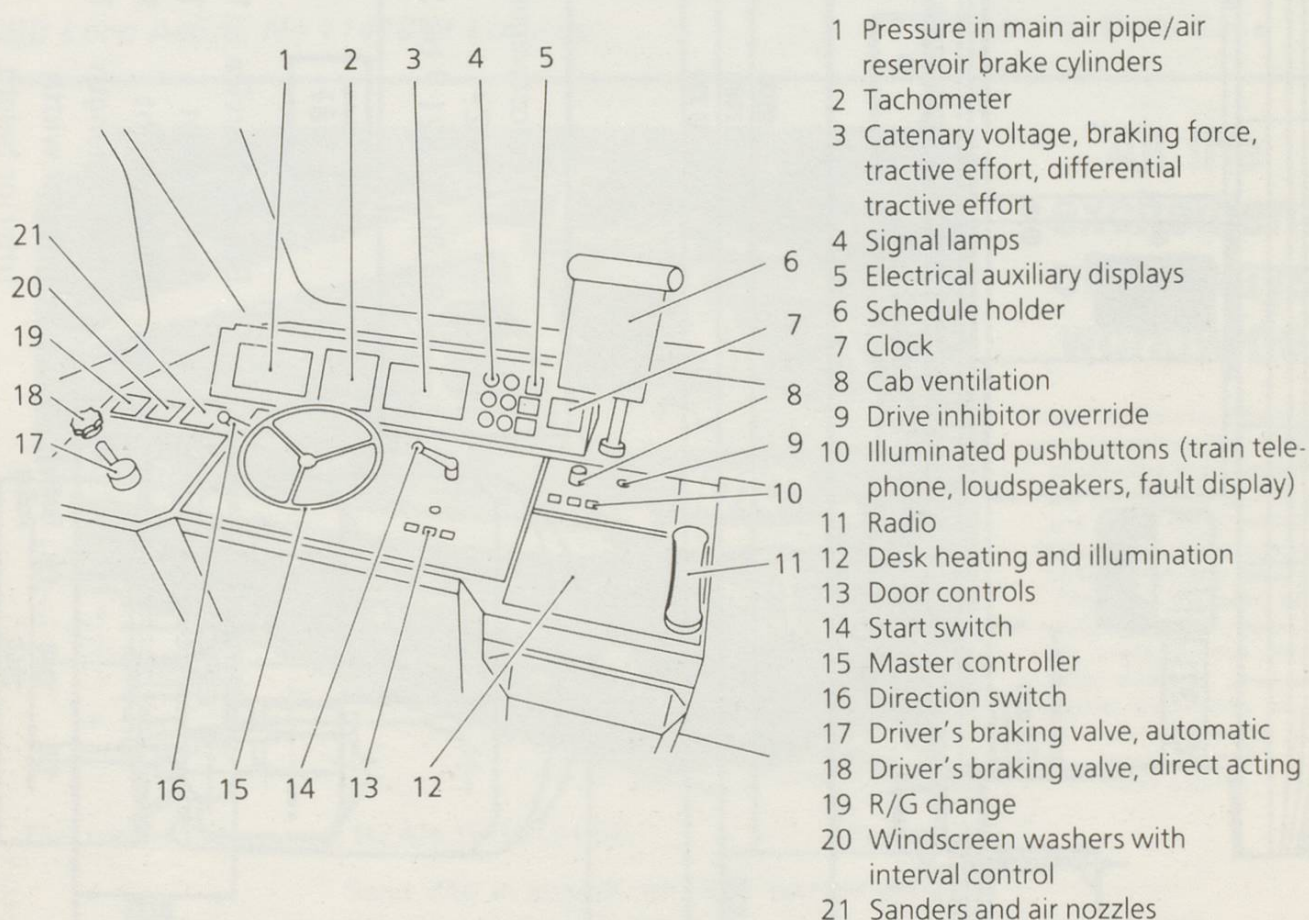
The Swiss railways are well known for their very small radius curves, and this proved a major problem with short wheelbase driven bogies. To overcome this problem SLM pioneered a design which is called the "Shifting axle drive" that allows the axles limited movement in accordance with the curve. This design has been used on the FO (HGe4/4 III), MOB (GDe4/4) and most important of all the GFM (GDe4/4) with its 45 metre radius curves, and has proven to be very reliable. The BT, SZU Re4/4 locos are fitted with a development of that principle which is called the self steering shifting axle drive system which by allowing up to + or - 12 mm of movement in the axle horizontal plane gives much better rail handling and a smoother ride. This type of axle unit will also be fitted to the new SBB Re4/4V 'S' Bahn locomotives which are being built by SLM/BBC.

The electrical system built and installed by BBC Brown Boveri AG of Baden, consists of an oil cooled disc wound main transformer which is fitted with six secondary windings for the traction supply and three secondary windings for the auxiliary supplies and train busbar. An 800 volt winding supplies a full wave bridge rectifier which in turn feeds a gate operated thyristor (2kV 2.0 kA) DC/AC convertor. The control and trigger



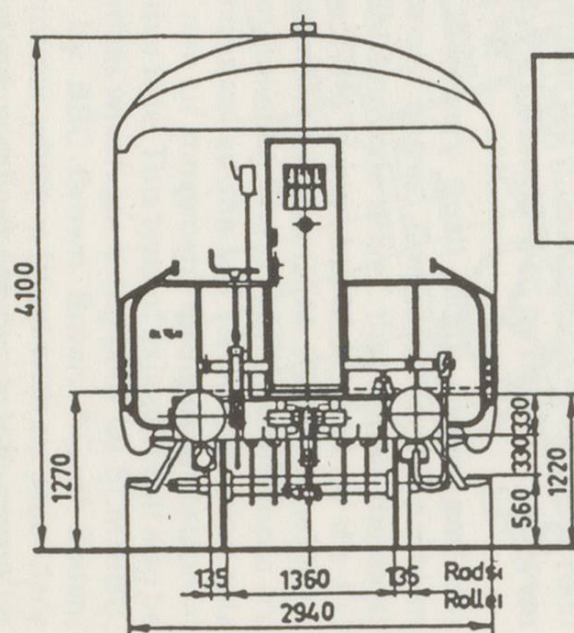
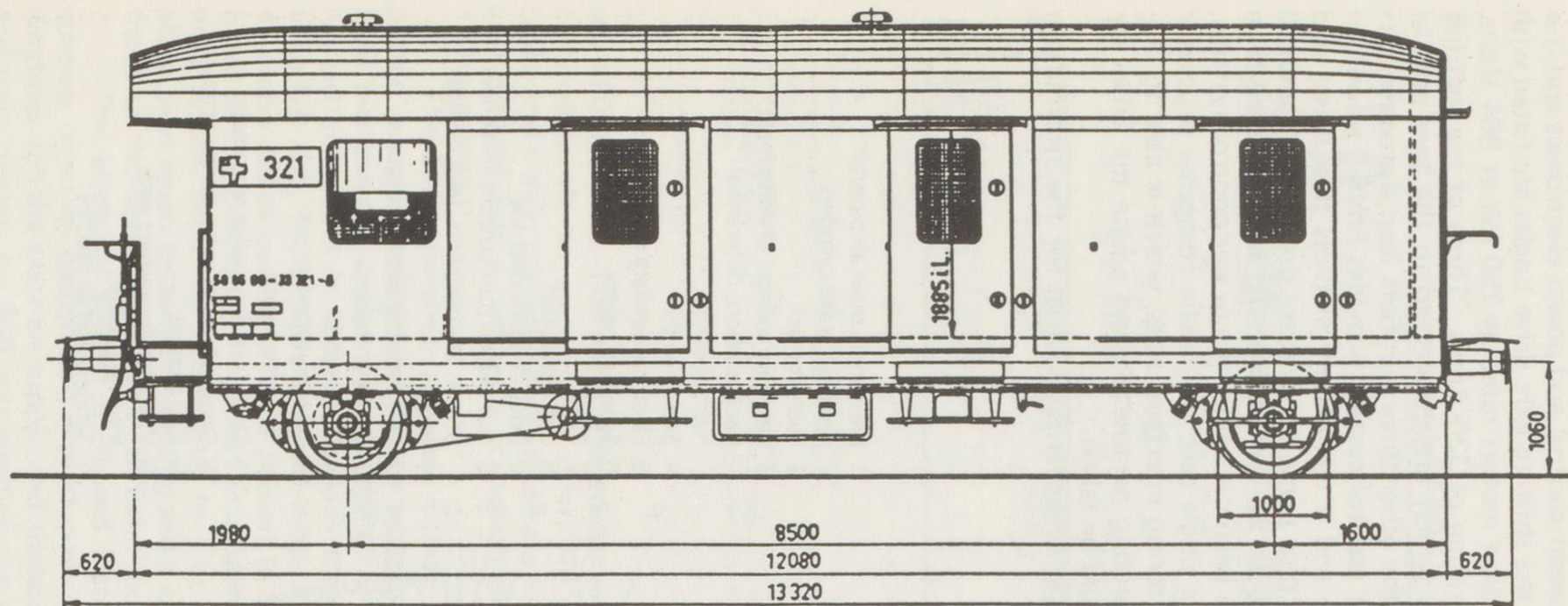
pulses for the Thyristors are generated by four integrated microcontrollers which send their outputs via fibre optic cables to the gate control unit where the information is converted back into digital electrical pulses. The fibre optic method of signal transmission is used to provide a complete separation between control and power electronics and it is most importantly interference free. Each of the shifting axle drive bogies are fitted with two 3 phase asynchronous squirrel cage traction motors rated at 750 kW at 964 Volts, with each motor phase having a continuous rating of 320 Amps. Three of the rectifier units feed into a bank of three convertors which are connected to the two parallel connected traction motors on one bogie, and the other three rectifiers feed the convertors and motors for the second bogie. This motor control system provides limited power on at least one bogie in the event of a failure and a completely stepless free speed and adhesion control during the adhesion mode, plus complete control down to a standstill during the regenerative braking mode. It should be mentioned that to date there have been no failures on any locomotive which has been caused by the power control systems. The entire electrical system is controlled by a single card diagnostic computer processor unit fed by various control and power monitoring interface units, which is able to pinpoint any variations outside the normal operating parameters and advise the driver by an easily read print out upon what action should be taken.

My thanks to Herr Dürmüller of the SLM Engineering Journal for the information and drawings which made this article possible.



*Arrangement of instruments and controls in driver's cab.*

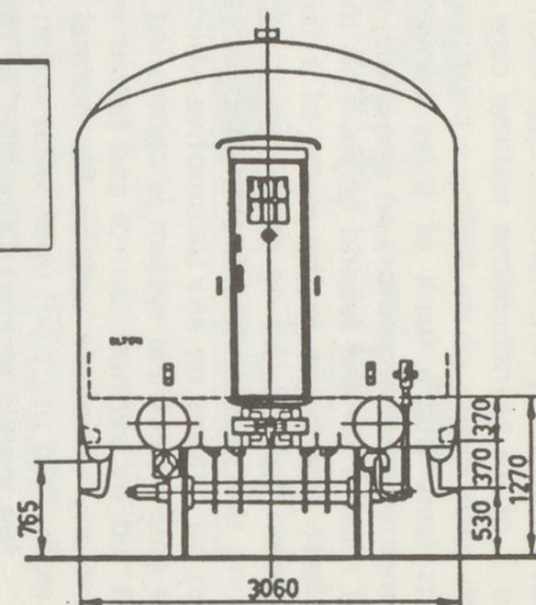




Paketpostwagen  
Z<sup>2</sup>  
50 85 00-33 321-8 bis 33 331-7

Maßstab  
1:87

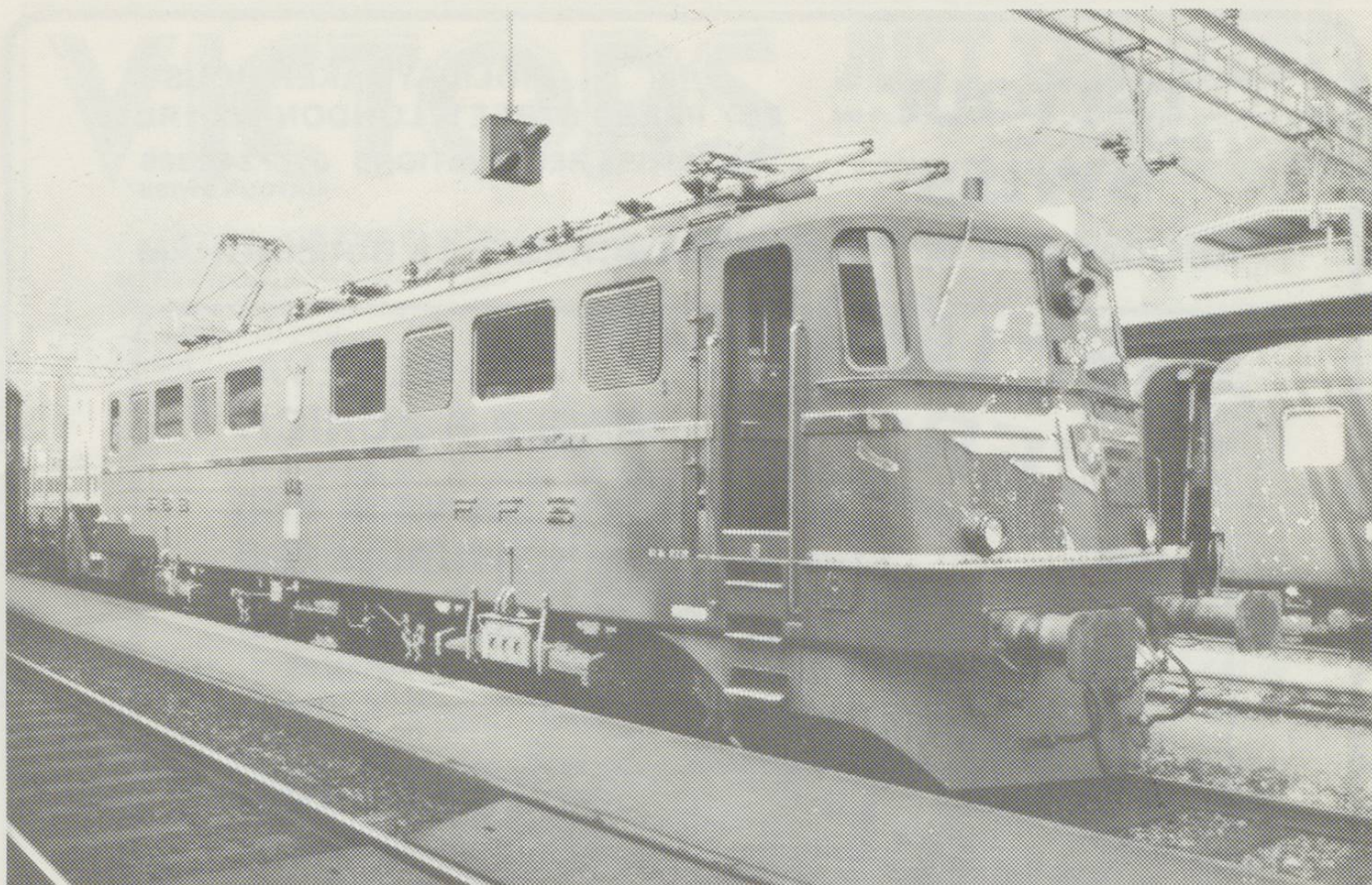
Entered service	1949
Tare weight	19 t
Load weight	12 t
Interior length	11,24 m
Interior width	2,82 m
Interior height	2,00 m



Drawing SBB

Supplied By J. Jesson





*SBB Loco Ae6/6. No 11418 at Locarno.*

Photo: G. Della Gana



*Elektrische Lokomotive Re 4/4 IV 10101-04.*

Photo SBB

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