Philips Early Noval Tubes, also advertised as ‘Innoval’

Even before WWII Philips had developed its own all-glass tube families intended for the then emerging TV market. All glass tubes could help to reduce inductance and capacitance of leads, thus increasing the useful frequency.

EF50 was the result of the early design efforts. EF50, with its B9G base probably derived from the Sylvania ‘loktal’ design, was the most appreciated amplifier in radar applications in Great Britain during WWII.

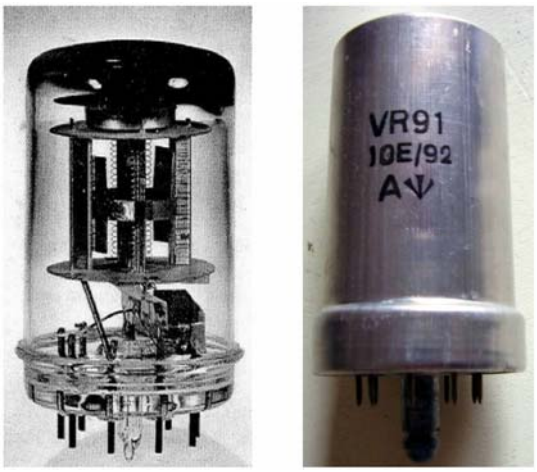


Fig. 1 - Internal construction of EF50 VHF pentode and VR91, one of its British derivative with metal shielding can over the glass body. The exhaust tube in the middle of the base is protected by a metal spigot with the polarizing key and the locking head.

The next step at Philips was the introduction of tubes for portable sets, with miniature all-glass envelope. In America RCA had introduced its family of 7-pin B7G miniature tubes in 1939. The Philips answer was the 8-pin rimlock family. With its 22 mm diameter and the 8-pin base this family could easily accomodate electrode assemblies of existing tubes with side-contact European base, up to the 14 W power output pentode. To prevent pin bending when inserting the tube in its socket, a guide stud was embossed in the glass body, near to the base, or in a metal collar.

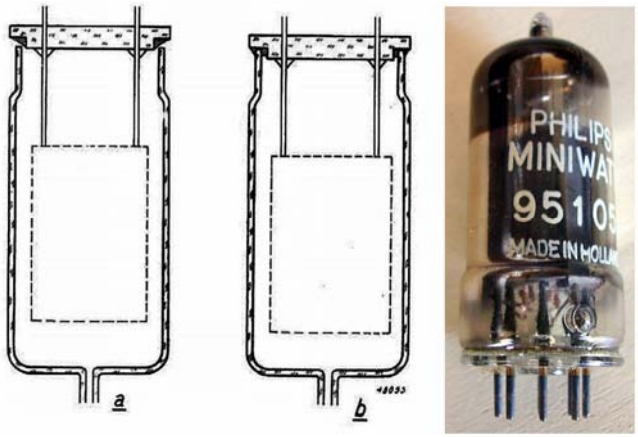
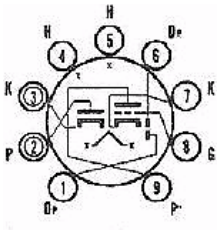


Fig. 2 - Left, the sealing of the base and electrode assembly against the envelope using a precision low-temperature ‘glazing’ process. Right an all-glass rimlock tube, showing the guiding stud.

The same socket was fitted with a metal collar, a guide and a spring lock for the polarization stud. The design choices and the processes were all selected for the highest reliability of the tubes in every applications. The hard metal pins were rigid enough and some of them supported the electrode system well centered in the bulb, no need for large mica spacers. The low sealing temperature did not soften the envelope or the base glass button, granting the best mechanical precision of pins and of electrodes. The cathode poisoning due to oxidation at high temperature was very low. A description of the solutions and of the characteristics of rimlock tubes can be found in this Philips article from 1946.

Rimlock tubes were widely accepted by European radio manufacturers but had two drawbacks against the emerging noval types, they were expensive and had only eight pins. When regular FM programs started in Europe in the early fifties, a new multi-unit tube was introduced in America as FM and AM detector/discriminator and audio low-level amplifier. The tube was the noval 6T8, an all-glass triple-diode triode.



Probably just 6T8 was the Trojan horse that forced Philips to switch to noval tubes in Europe in a few years. In AM/FM radios this tube alone could replace a couple of rimlock types, as the EAF42, AM detector and amplifier, and the EB41, FM discriminator. From about 1952 Philips started supplying its European customers with mixed kits including rimlock types and EABC80, the European code for 6T8. Another noval tube, the ECC81, was derived from American 12AT7. This one proved to be a more efficient solution to replace the couple of EF42 previously used in Europe in FM tuners, one as mixer and one as local oscillator. Nevertheless for some years we see in European radios a mix of rimlock and noval tubes, with the addition of octal or even other base types in the power stages. The table below shows the tube line-up for some German AM/FM radio models in the years from 1951 to 1954.

Mfr. & model	Year	Tube line-up (magic eye and rectifier excluded)
Graetz 154W	1951-1952	EF42, EF42, ECH42, EBF80, EB41, EF43, EL41
Graetz 156W	1952-1953	EF42, EF42, ECH42, EF41, EAF42, EB41, EF41, EL11
Graetz 160W	1952-1953	ECC81, ECH81, EF85, EABC80, EL41, AZ41
Graetz 176W	1953-1954	EC92, EC92, EF41, ECH81, EF41, EABC80, EC92, EL84, EL84
SABA Meersburg	1952-1953	EF80, EC92, ECH81, EF85, EABC80, EL34
SABA Bodensee	1953-1954	EF80, EC92, ECH81, EF41, EAF42, EABC80, EL12
TeKaDe Melodie W387	1953	EC92, EC92, ECH81, EF41, EF41, EABC80, EL41

We find that rimlock tubes were still in use around the mid fifties, mixed to more recent noval types. Nevertheless we cannot find an apparent logic in the tube line-up of the above radio models. Certainly Philips sold and then manufactured noval tubes in Europe from the late 1951. We can assume that early productions were launched in countries better linked by trade relations with America, as Great Britain, Australia and maybe Germany.

Looking at the old AM/FM German radios of the table above, we find some quite special noval tubes. They look very similar in construction to rimlock tubes, with the base glazed to the envelope and the electrode system often supported only by a couple of rods top-welded to some pins, no large mica spacers touching the glass wall. This can be explained assuming that the productions of noval tubes were run on the same lines already making rimlock types, using the same processes and maybe even similar electrode assemblies in some cases. From the codes printed on the glass of the base we learn that these noval tubes, sometimes advertised as ‘innovals’, were made by Mullard, Blackburn, by Valvo, Hamburg and by Wiener Radio Werke.

Here some photos of the early Philips ‘glazed’ noval tubes.

Fig. 3 - Samples of very early European EABC80s. The first one is branded TeKaDe while the second and the third ones are branded Valvo. Anyway all have an Y4B short code printed on the base and probably were pumped at the Mullard Blackburn plant in England. In the three samples above the base is glazed to the envelope by low temperature sealing process and the electrode assembly is held rigidly by a couple of rods well visible in the first photo, no need for mica spacers. The last sample on the right is the normal miniature version.

Fig. 4 - Two images of an early glazed version of European ECC81 /12AT7. Although branded as Valvo, its short code Y4B printed on the base suggests a British Mullard production, at least up to pumping. The last sample is a more recent miniature Philips 12AT7.

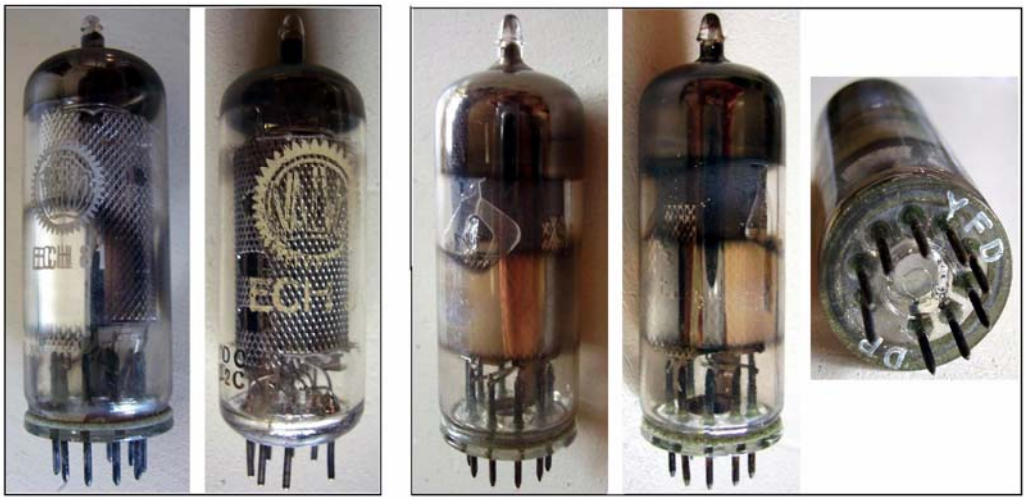


Fig. 5 - Two more early noval tubes from Philips related plants. On the left an early glazed ECH81 frequency converter near to a more recent unit. From center to right three images of a glazed EF80 probably pumped at Valvo, Hamburg.

Fig. 6 - Two images of an early glazed EF85. According to the short code stamped on the base, Y3A, this sample was probably pumped at Wiener Radio Werke.

Glazed noval tubes can be no longer found in radio sets approximately manufactured from about 1953. Nevertheless some professional types survived in their glazed version, probably because their low volumes did not justify a redesign of the electrode assembly.

Fig. 7 - The two photos on the left show a temperature limited diode 56001, intended to be used as feedback sensor in AC voltage stabilizer circuits. On the right we see another temperature limited diode, the K81A, intended for use as noise generator. Both were assembled with base glazing technique.

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