Vintage Radio

By Associate Professor Graham Parslow

Pye 1951 5-Valve Model APJ-Modified

Pye's 1951 Model APJ-Modified is a conventional post-war receiver featuring three shortwave bands, a 5-valve superhet circuit and a cut-price timber cabinet. It also has a trap for the unwary – an output transformer frame that's connected directly to the HT from the rectifier!

THE MODEL APJ Modified was one of Pye's first Australian-built radios. Manufactured in 1951, it reflects the shortages imposed by World War 2 on Australian society at the time.

The first thing you notice is that the simple timber case is made of 5-ply timber. In this respect, contemporary timber cabinet Astors and STC radios both had similar minimalist construction techniques during the early 1950s. The veneered cabinets have character but they don't really compare to the high-quality timber cabinets seen on pre-war radios.

Pye's model APJ is some 520mm wide, so it is quite a large mantel radio. It uses a fairly standard superhet circuit with a proven valve line-up and the only two real advances incorporated into the radio for the time are a thermo-mouldable plastic surround (ie, not Bakelite) and a 6AV6 miniature valve.

As well as tuning the standard broadcast band, this radio also covers three shortwave bands and the dial shows the wavelengths on which major European world services could be heard. The colours on the dial conveniently correspond with the colour-coded wave change switch on the side of the radio, making it easy to select the desired band.

This was a time when "new Australians" from Europe were keen to maintain contact with their country of birth, so shortwave listening was popular. This pastime has now virtually ceased, as the internet and other media services have made shortwave services an anachronism. As revealed later, I accidentally confirmed just how little of the shortwave spectrum is now used for transmissions.

Circuit details

Fig.1 shows the circuit details of Pye's Model APJ Modified, as detailed in the Australian Official Radio Service Manual (AORSM) of 1951. As can be seen, the front-end is rather densely packed with the band-change coils and selection switches. The mixer-oscillator valve (6J8G) is at the core of all these circuits and provides a 455kHz IF signal which is then fed via the IF transformer (53) to an IF amplifier stage based on a 6U7G. There is no tuned RF amplification, so only a 2-gang tuning capacitor is required.

This is the "modified" version of the circuit but that doesn't reflect a later improvement to the original circuit. Instead, it's a reflection of the early 1950s when many commodities were in short supply. This was a time when bricks and cement were rationed for new home builders. Similarly, some valve types were hard to obtain.

The unmodified front-end circuit is shown in Fig.2 and this features a miniature 6AN7 valve as the converter. The Pye service notes state that "it was intended to use a converter valve type 6AN7 in the model APJ receiver. As supplies of this valve were not available at the time of production, a type

Warning High Voltages!

Note that the output transformer in this set is mounted on an insulated stand-off from the chassis and its exposed metal frame is connected to the full HT voltage.

6J8 or 6J8A converter valve was used".

The 6J8 used in the radio described here is a conventional octal valve with a grid terminal at the top. The valve is fitted with an earthed goat shield to keep it stable and reduce interference; it was referred to as a goat shield, because it was made by a company called Goat Radio Tube Inc in the USA.

The service notes offer the following information: "the alterations made to use the 6J8 are as follows: (A) 60,000 Ohm resistor number 41 changes to 30,000 Ohms 1 watt and becomes number 69. (B) 6pF condenser 68 is deleted. (C) 4pF condenser 67 is deleted. (D) 200 Ohm resistor 47 changes to 200 Ohms 1/2 Watt and becomes component 70. (E) A valve shield part PN217 is required and a valve shield earth clip. (F) The 9-pin socket is changed to an 8-pin socket part PM532. (G) A grid clip part 873/495 is required for the 6J8 control grid".

The octal 6U7 IF amplifier that follows the 6J8 also has a close fitting goat shield. The 6U7 in this radio had a broken octal locating spigot. Fortunately, the earth-contact strap for the shield clearly indicates pin 1.

The amplified IF signal from the 6U7G is fed via a second IF transformer (54) to a 6AV6 double-diode triode valve. This valve is fitted to a 7-pin socket which in turn is attached to the chassis using an adapter that fits a hole punched for an octal valve. It is clear from the high number of punched holes in the APJ's chassis that this chassis was used as a platform for a range of products. In this set though, "APJ-846" is stamped into the chassis adjacent to the 6AV6 socket to aid identification.

The 7-pin miniature 6AV6 has three functions: (1) it acts as a detector to recover the audio signal from the IF signal, (2) it rectifies the IF to produce an AGC signal and (3) the triode section acts as an audio preamplifier stage. The valve is supplied with a simple slip-on metal shield that's earthed with copper braid.

The recovered audio from the 6AV6's detector is fed to a 6V6G audio output valve. This is a large octal valve that was used in the majority of Australian radios from the late 1930s until the 1950s. It was also made as the physically more compact 6V6GT.

The 6V6 is designated as a beam-power tetrode and was introduced by Ken-Rad in 1936. It was later super-

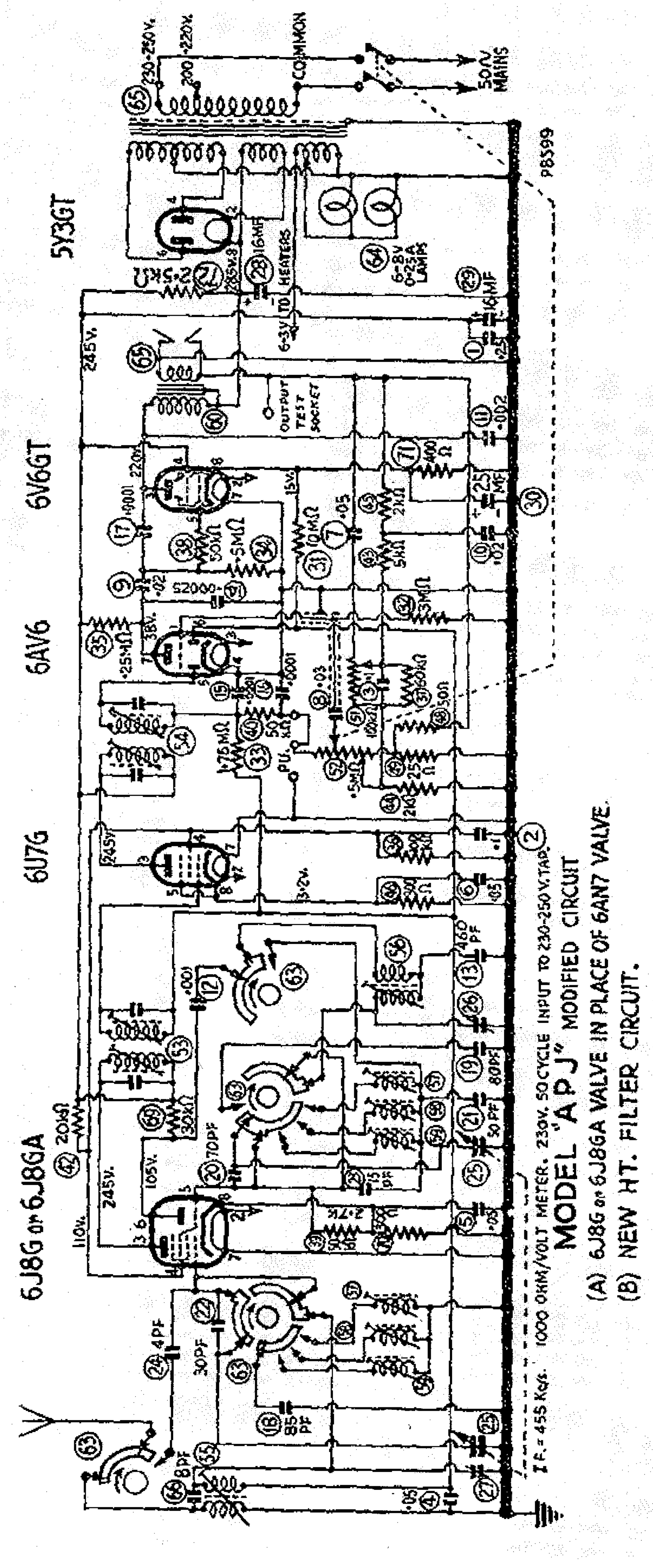
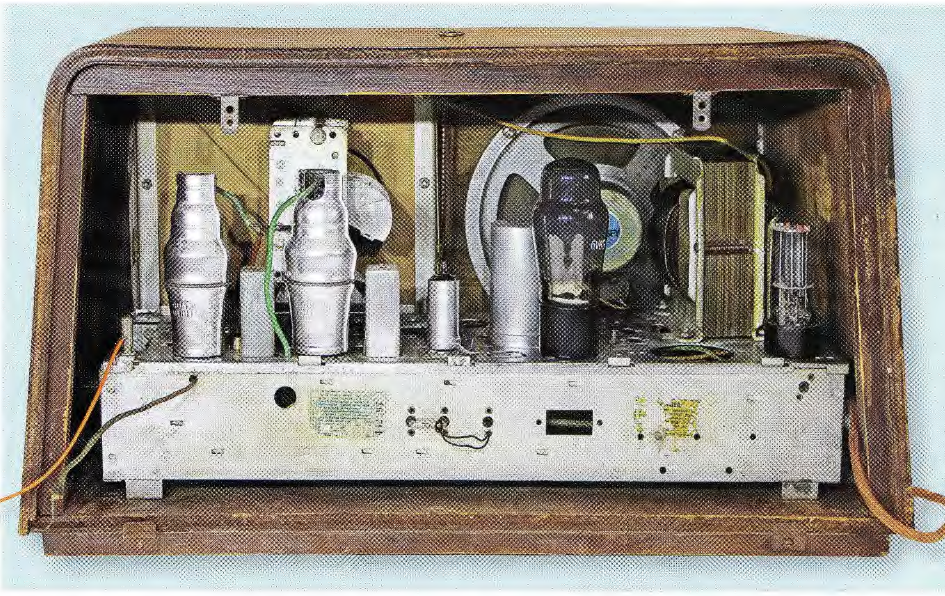


Fig.1: Pye's Model APJ-Modified set is a superhet design covering three shortwave bands and containing five valves. An amplified IF signal is fed from the octal 6U7 valve to an IF transformer (54) and then to a 7-pin 6AV6 double-diode triod valve. The 6AV6 acts as a detector to recover the audio signal from the IF signal which is then fed to the 6V6G audio output valve.



Rear view of the Model APJ-Modified set and the base of an octal 6U7G IF amplifier.

seded in the 1950s by the 6AQ5 (Mullard-Philips EL90), a miniature 7-pin valve with ratings virtually identical to the 6V6.

Although both variants of the APJ model had a primary HT of 285V, the modified variant changed the 6V6 cathode bias resistor from 300Ω to 400Ω to generate a higher negative grid bias. The presumably better placed the valve in its linear response range for less distortion. Certainly, this radio was capable of delivering a high volume with good fidelity.

An additional change for component economy in the modified APJ was to replace component 61, a 14 Henry 80mA choke, with two 5kΩ resistors in parallel. The radio featured here has these resistors and these would be much cheaper than using a choke to help filter the HT from the 5Y3GT rectifier valve.

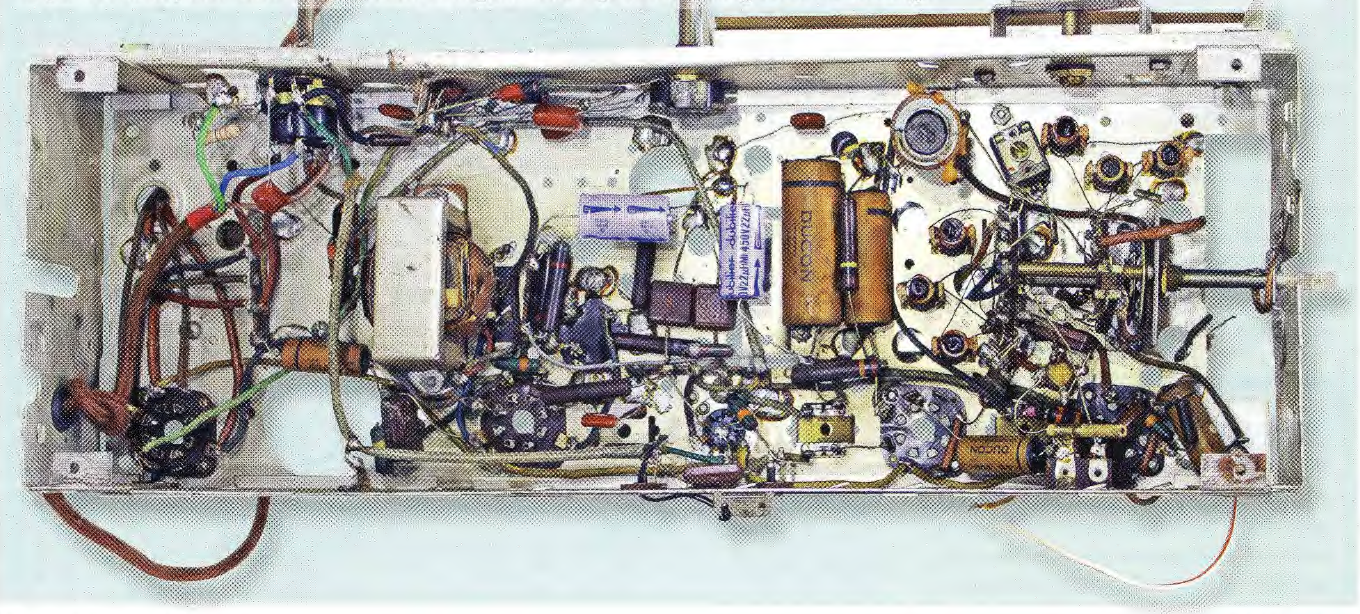
In this radio, a previous owner had replaced the two HT filter electrolytics. Both are specified as 16µF types on the circuit and both were housed in the same can on the top of the chassis. The replacement capacitors were 22µF 450V types and although the choke was absent (having been replaced with the resistors) the filtering was effective because hum was negligible.

Fortunately, the original capacitors had simply been disconnected from the circuit and the can left in place adjacent to the 6V6 output valve. The new capacitors were simply wired into place underneath the chassis.

The rectifier valve in this radio is a 5V4, rather than a 5Y3 as shown on the circuit. The 5V4 is pin-compatible with the 5Y3 but has less internal resistance. The circuit diagram indicates that the HT (high-tension voltage) from the rectifier should be 285V DC but with a 5V4 in place, the measured HT was 329V. The radio was designed for a 230VAC supply, so the higher 240VAC mains at my house also contributed to the elevated HT.

Inserting a 1.5kΩ 5W resistor in series with pin 8 of the 5V4 brought the HT back to a more reasonable 280V.

You can see two replacement 22µF 450V HT filter capacitors near the centre of the set. These were originally 16µF electrolytics and the increased capacitance provided improved filtering.



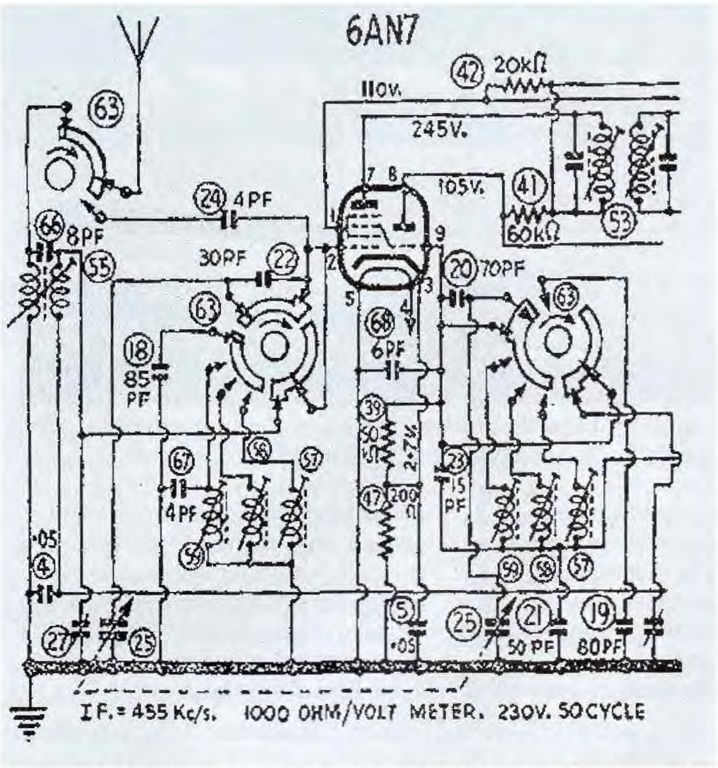
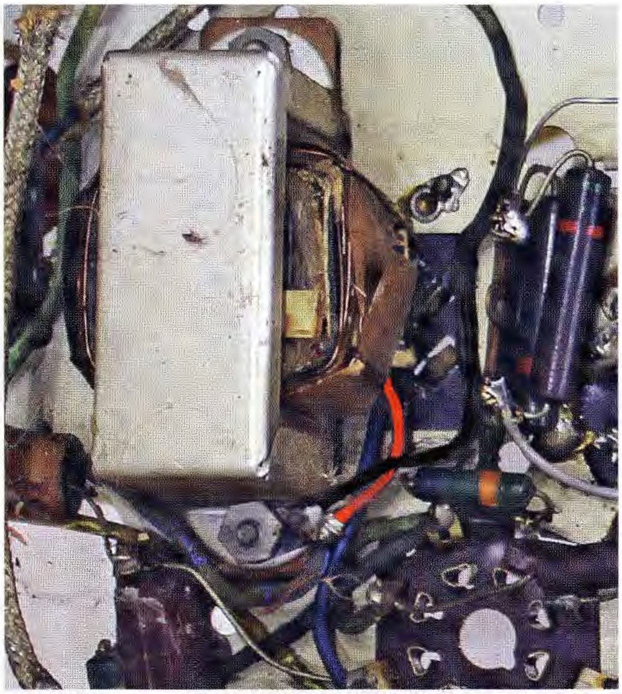


Fig.2: a 6AN7 converter valve was originally meant to be used, but due to a shortage of this type of valve during production, a 6J8 or 6J8A converter valve was used instead.


A particular problem in this set is that the HT from the rectifier and the secondary of the output transformer were connected to its frame, which was insulated from the chassis. This particular set also had excessive HT of 329V which caused occasional arcing between the output transformer primary and the earthed secondary.

This also eliminated occasional arcing (induced by the overvoltage) that could be seen as flashes between the output transformer primary (at full HT) and the earthed secondary.

And here a word of warning! If you come across one of these radios, note that the output transformer is mounted on an insulated stand-off from the chassis and its exposed metal frame is connected to the full HT (see Fig.1). The manufacturer provides no specific warning of the extreme danger, although a decal on the chassis does give a general warning as to the presence of high voltages.

So why was the output transformer's frame connected to the HT? The reason is that connecting the transformer's frame to its primary (and thus to the HT from the rectifier) helps prevent electrolytic spot corrosion of the fine wire used in the winding.

Chassis restoration

Superficially at least, the radio looked reasonably serviceable as it came to me. The speaker had obviously been replaced at some time in the past, because the Plessey brand did not appear until the 1960s, well after the set had been manufactured. The replacement speaker was also a twin-cone type which made it all the better for quality though not authenticity.

A couple of problems were also immediately evident. First, the wiring to the grid cap of the 6U7 was in rather a poor state and would have to be replaced. In addition, the external insulation on the mains transformer had broken away, exposing the low-voltage filament windings.

Removing the chassis exposed further problems. The first thing I noticed was that it was covered in a uniform brown staining that was particularly evident on the plates of the tuning gang. This radio had obviously spent quite some time absorbing nicotine in a household of smokers.

The nicotine staining was so pervasive and intractable to mild cleaning that it was a job for degreaser. First, the valves were removed, the loudspeaker detached and the mains transformer water-protected by covering it with plastic wrap. The chassis was then judiciously sprayed with degreaser, brushed clean with water and thoroughly dried with compressed air.

The plates of the tuning gang emerged from this process positively gleaming. Many corrosion spots were then removed from the steel chassis by scouring with steel wool, taking care to blow debris away. The speaker was kept well away during this process, as iron particles will attach themselves tenaciously to speaker magnets.

Looking under the chassis revealed that most of the original paper capacitors had already been replaced, so that was a good start. One paper capacitor still in place was the 0.05μF cathode bypass on the 6U7 valve. Unfortunately, it


The outer insulation on the mains transformer was broken exposing some of the low voltage windings.

The "Pye-Unicam" brand first became familiar to me from the 1960s when it was encountered on high-quality laboratory equipment, particularly spectrophotometers. "Pye" is a family name, while "Unicam" is a contraction of The University of Cambridge.

W. G. Pye & Co Ltd was founded in 1896 by William George Pye, an employee of the Cavendish Laboratory at Cambridge, as a part-time business making scientific instruments. By developing a line of thermionic valves during WW1, Pye was among the first to manufacture a radio receiver for the first UK broadcasts made by the British Broadcasting Company in 1922.

In Australia, Pye opened a large factory in Clayton (Melbourne) in 1950 and specialised in 2-way radio communications equipment. Domestic radios were a less important line and it is probable that they were made in a separate factory in Abbortsford, Melbourne (perhaps a reader could provide some definitive information on the radio manufacturing site).

Continued diversification and Asian competition eventually led to Pye becoming unprofitable. From 1966, the company was progressively taken over by Philips, who still use the Pye brand for niche audio products. This has made Pye one of the longest surviving brands in the field of electronics.

Pye Australia building at Clayton; image courtesy of Kevin Poulter
www.pyetelecomhistory.org/comphist/australia-part1.html

blocked access to the lead to the 6U7's grid cap. Removing it allowed the grid cap lead to be replaced, after which the capacitor was replaced with a modern equivalent. Any remaining paper capacitors were also replaced.

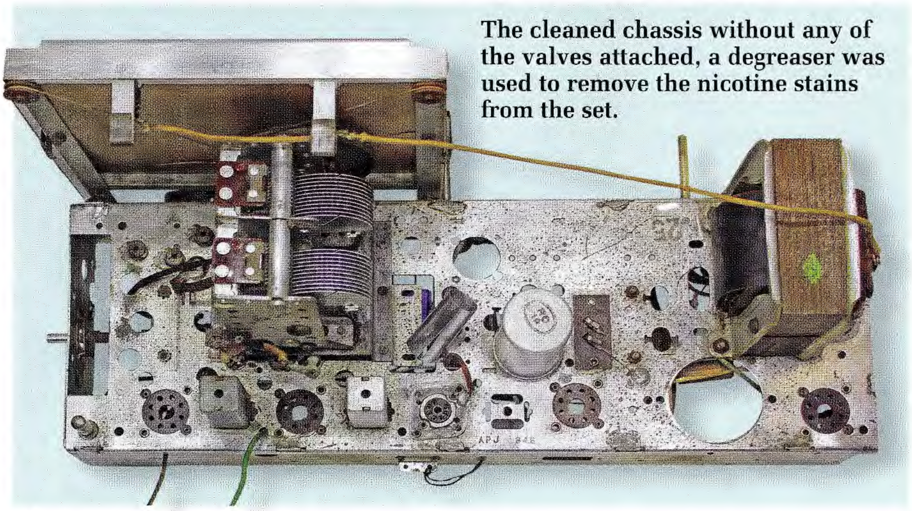
Next, I removed the knot restraining the mains cord and fitted a proper chassis clamp. I then powered the set up and with no valves in place, it consumed 7W. What's more, the two dial lamps lit up as expected and the transformer remained cool, so the initial indications were promising.

It's interesting to note that the dial lamps are powered from a 5.9VAC tap on the 6.3VAC filament winding. The lamps themselves are specified as 6-8V types, so operating them at 5.9VAC should result in good lamp life. Although nominally 6.3VAC, the measured filament voltage was in fact 6.5VAC, no doubt due to the fact that the set was originally designed for a 230VAC input.

At this point, the valves were installed, the speaker reconnected and the set powered up again. I was optimistic that it would work but unfortunately, I was unable to tune any stations and only crackling noises came from the speaker.

Some gentle prodding soon pointed to the 6AV6 valve as the source of the crackling. It was making intermittent contact with its socket and after cleaning the valve pins the crackle went away. However, I was still unable to tune any stations across the band.

It was then that I realised that the wave-change selector switch was set to the lowest of the shortwave bands. I rotated the switch to the broadcast band and the set came to life. It performed quite well, the only problem being intermittent changes in the volume. This problem was quickly traced to a dry joint in the negative feedback connection at the output transformer's secondary and fixed.



The cleaned chassis without any of the valves attached, a degreaser was used to remove the nicotine stains from the set.

Restoring the cabinet

Over the years, heat from the valves had cracked the lacquer applied to the cabinet, indicating that this set had had a long service life. To fix this, the timber was sanded back to remove all traces of lacquer, after which a light oak stain was applied to give more character to an otherwise bland appearance. The exposed edge of the plywood used for the face board was then painted black.

Several coats of satin-finish polyurethane were then sprayed on, with light sanding between coats. Then an enamel Pye badge was fixed to the top of the cabinet to replace the Pye decal lost by sanding.

Finally, the knobs had silver paint brushed into their individually etched labels for volume, tone and tuning. And that was it – the set is a good performer and has been added to my collection. SC