

## PRODUCTION OF VT90 (710A) VALVES IN AUSTRALIA

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Amalgamated Wireless (Australasia) Ltd., which was a company formed in 1913 to combine the local interests of the Marconi and Telefunken companies, thereby solving patent-litigation problems that had arisen, set up a valve manufacturing plant in Sydney in 1933. In 1935 the Philips Lamps (Australasia) Pty. Ltd. company built a factory to assemble imported valve components. The A. W. Valve Co. (i. e., the Amalgamated Wireless subsidiary) started transmitter-valve production in 1937 based on Marconi and RCA designs. Standard Telephones and Cables Ltd., the English company later known as STC, commenced valve manufacture in Sydney in 1939. Among them they made 80% of all valves used in Australia for broadcast purposes. The Australian industry relied almost entirely on imported raw materials, so that, when the war was declared in Europe, Philips and STC both lost supply and only Amalgamated Wireless, or AWA, had any stockpile of materials.

Following the revelation of the secrets of radar to Commonwealth countries in 1939, Australia established a research division known as the Radio Physics Laboratory or RPL, which was to collaborate with the UK on the design and development of radar. Initially it was expected that the UK would supply all stocks of the necessary valves and other difficult-to-make items, but the RPL did propose to do some valve research and to recondition the English Admiralty valves used in Australian Navy ships.

In the latter half of 1940 the RPL did some work on perfecting techniques for making metal-to-glass seals for TR switching diodes to be used in radars, but concentrated on the design of air and ground radar sets to suit Australian requirements, all of which utilised a pair of the UK-made VT90 "micropup" triodes (U. S. 710A). However, these valves were in the RF output stage of the UK ASV Mk II radar and were needed in large quantities for the English war effort. When the supply of valves from the UK became even more precarious than previously, the RPL in conjunction with the Department of Munitions, which was responsible for quantity production of defence equipment, approached the UK Ministry of Aircraft Production in September 1940 for permission to manufacture the VT90 valve. The UK agreed to release manufacturing information to STC via its UK parent, the General Electric Company, and its valve-manufacturing associate, the M-O Valve Co.

However, by December 1941 STC had determined that the only glass suitable for VT90 production was C9 grade available from B. T. H. (the British Thomson-Houston Co.), although the Australian Glass Manufacturers Ltd. was investigating the practicality of local supply. Around 10-15 tons was required.

About 100 pounds of nickel was needed and Wright & Co., a specialist metals importer and supplier, would try to locate a suitable grade from overseas.

One ton of tungsten and 100 pounds of molybdenum was required, but there was no Australian company able to refine and process it. It was hoped that it

might be available via the local electric-lamp industry.

The tantalum wire used for VT90 grids was available only from one USA company.

STC was eventually allocated emergency supplies of raw materials and components and commenced manufacture of the VT90 toward the end of 1941, but by February 1942 production was halted again due to lack of materials, after only 50 valves had been made. The situation was not resolved until September 1942 when re-allocated materials became available. STC was then able to make VT90s at the rate of 200-300 per month. I don't have any total production figures for STC but suspect it would be only a few thousand. Total Australian production of ground radars with VT90s was about 500 and local manufacture of ASV MK II was about 1100 between 1942 and 1945. That's 3200 VT90s. If we include an allowance for spares it could come to maybe 10,000 valves. I don't have the US and Canadian deliveries but expect they were significant so that doesn't leave many local units. For other valves the ratio of local production to imports was running at about 1:10 to 1:20.

In the mean time, emergency supplies of VT90s were obtained from UK stocks, which by now included quantities coming from the US and Canada with their vastly greater production capacity. Even so, the total number of VT90s in stock in Australia in April 1942 was about 100.

By this stage the Australian radar manufacturing effort had been rationalised to an RAAF-operated Air Warning set called the AW, with a 10-15 kW pulse output, later lightened to be the LW/AW (for Light Weight/Air Warning), but this set was urgently needed and used two VT90s, and of course at least another four for spares. As an interim measure, the RPL re-designed the transmitter with a four-valve ring oscillator using Eimac 100TH valves held in stock for pre-war amateur-radio use. It had an output up to 50 kW. Twenty-three sets were built for the RAAF and Navy before supplies of VT90s became available again.

The ramping-up of overseas orders and local production meant that the VT90 shortages were soon relieved and in fact there was the embarrassing situation whereby there were many thousands of VT90s in storage. Even though the radar operators were prone to wind the voltages up "a bit" for more range, which inevitably resulted in the VT90s "going off like popcorn," the valve was no longer a problem. Instead, as often happens, a shortage of another part, the 1852 (6AC7) valves for the receiver, became a limiting factor in commissioning of radar stations until January 1943 when 17,000 were shipped in from the USA. Incidentally, a very high proportion of these shipments were faulty due to inter-electrode short circuits.

Both STC and AWA went on to develop and produce a number of magnetrons and other military valves, diodes, etc., but it was really a case of too little, too late. The military planners could not forecast their needs and consequently vastly over-ordered both locally and overseas, which resulted in stockpiles of millions of unused valves by war's end. The local electronics and metals-processing industries did benefit from gaining access to new technology and manufacturing processes during the period.

The VT90 was originally designated as the E1046, then E1046A. To confuse matters, the UK researchers then scaled up the design for more power and called the new versions E1046B, C, D, E and F, all called "micropups." There

was even a microwave version called the "millimicropup." The service designations that I can remember were:

E1046 or E1046A	VT90
E1046B	NT93
E1046D	NT99

I have four VT90s which have the following designations:

10E/97B Ser. No. 1-5357 W (in a circle, which I assume is Westinghouse)  
Ser. No. 45134 - REL #1, mfd. by N. E. Co.  
Ser. No. 47872 - REL #1, mfd. by N. E. Co.  
Ser. No. 49358 - REL #1, mfd. by N. E. Co.

The cartons are each hand lettered with "97B," obviously from the Westinghouse nomenclature, but this may have been the surplus dealer's coding.

You will note that it took STC two years to get the VT90 into production. It took the RPL a similar time to make their first radar set and even then that was a hastily re-configured ASV Mk II from UK that they had been playing with. The stories of inefficiency and mismanagement are another matter and of course it happened in every nation.