THE HEATHKIT 1KW S.S.B. AMPLIFIER HA14

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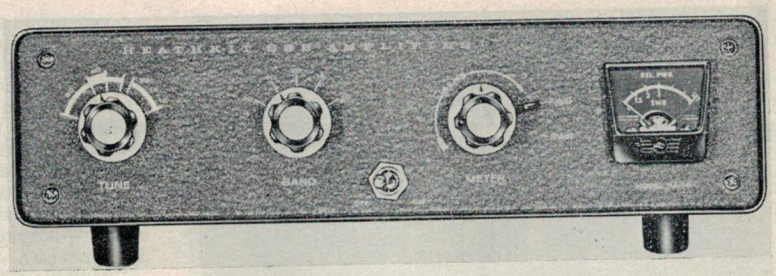

DAYSTROM Ltd. of England, market a wide range of American Heathkit s.s.b. equipment amongst which is the HA14 1 kW amplifier. The claim that this is the " world's smallest 1 kW amplifier " is probably justified.

The HA14 and its associated power unit the HP24 are normally advertised as kits, but were supplied to the RSGB for review as assembled units. The mail order prices for the HA14 and HP24 kits are £56 5s. 0d. and £29 5s. 0d. respectively. For assembled units the prices are £68 5s. 0d. and £35 5s. 0d. respectively.

Circuit Description

HA14: Two 572B (or T160-L) triodes are used in parallel as grounded grid amplifiers. These valves are of glass construction with carbon anodes and although they look old fashioned they are in fact of recent introduction. Power from the exciter is fed through a phono plug to the directly heated cathodes in which there is a preset matching circuit for each frequency band. A pi-output circuit is used but the output capacitor is a fixed type. This makes for a simple circuit but does mean that the amplifier will not be very efficient if the load is reactive or outside the impedance range required. The output socket is the u.h.f. series SO239.

A small meter is fitted which is connected to a simple reflectometer so that relative forward and reflected power is indicated. The sensitivity control is set to full scale on forward power and the meter reads v.s.w.r. when switched to the reflected power position. There is no provision for the measurement of anode current. The operator thus has no idea of the actual power output or d.c. input unless external metering is employed.

An internal relay is fitted so that the aerial is switched straight through to the exciter when the amplifier is not keyed. Keying is accomplished by shorting the −180 volts cut-off bias to ground through the relay and a resistor. An a.l.c. output is provided.

HP24: The power unit is very simple. Fourteen diodes in a full-wave doubler circuit feed six 125 μF 450 volt capacitors in series to give approximately 2500 volts no load. A single diode with a 30 μF 200 volt smoothing capacitor provides −180 volts bias.

The mains input is for 120 or 240 volts a.c. 60 c/s and the transformer is protected by an 8 amp resettable contact breaker in each leg.

Mechanical Construction

HA14: The amplifier is constructed in aluminium and has no chassis as such. All the components are mounted on the screens. Except for the input section, which includes the relay, accessibility is excellent. In spite of the lightweight construction the unit is very stiff and quite suitable for mobile use. The valves could not be easily removed as the base retaining clips fouled the bases. It is necessary to remove the single nut and bolt on the retainer to remove a valve. All voltages except the h.t. are brought in on a small 12 way Jones type chassis mounting plug.

The external finish is an attractive very fine green crackle paint.

HP24: The power unit is very compact with a similar finish to the amplifier. The e.h.t. is taken out on a special connector which is not considered very safe as it is possible to touch the conducting surface of the socket when the mating plug is disconnected. The other end of the e.h.t. lead is terminated in a plug which is dangerous. The e.h.t. lead has very thick transparent insulation and as supplied by Daystrom the terminating plug was badly connected in that the lead insulation stopped short of the plug. The conductor could be seen but not touched. Although the lead was reterminated the same thing tended to happen in use. The remaining voltages are taken out on an octal socket.

Testing the HA14

Due to limitations in the available drive units, full power testing was carried on 14 Mc/s only. The Heathkit specification could be construed as slightly misleading in that it says the power drive necessary is 100 watts. It does not say if this is actual r.f. watts or the d.c. input to the driver; in fact the former is the case. The power at the output socket on the other hand is in terms of d.c. power input. This is quite reasonable since Heathkit may have no control of the driver used, but it should be made clearer.

The maximum power output on single-tone test at 14 Mc/s was just over 600 watts.

The power gain, input v.s.w.r. and output v.s.w.r. on a 50 ohms load, as shown on the built-in meter, were measured and the following results obtained:

Band	Power Gain	Input V.S.W.R	V.S.W.R. Indicated
80m	1 : 7	1·2 : 1	1·2 : 1
40m	1 : 6·4	1·2 : 1	1·2 : 1
20m	1 : 8·3	1·2 : 1	1·3 : 1
15m	1 : 10·8	1·1 : 1	1·3 : 1
10m	1 : 8·4	2·5 : 1	1·3 : 1

The v.s.w.r. meter was not very satisfactory. On air testing, an aerial which had an actual feed v.s.w.r. less than 2 : 1 showed on the built in meter as having a v.s.w.r. greater than 3 : 1. Since the maximum advised in the Heathkit specification is 2 : 1 one could justifiably expect an accurate built-in meter.

Intermodulation Products

The claim is 30db at 1 kW input. On 14 Mc/s the HA14 was driven to full input with a driver which measured 30db intermodulation products. The HA14 did not degrade the input signal and was thus satisfactory.

Comments on the HP24 P.S.U.

This power unit is extremely compact and it is remarkable that so much comes from so little. There are catches however. The heater volts at the input to the HA14 are 12·5 a.c. When driven to full output by constant modulation these heater volts fall to 12·0. The only reason why this was noticed was that the heaters are particularly bright and it was

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observed that on whistling into the driver microphone, the heaters visibly dimmed. The e.h.t. was 2·56 kV on standby, 2·35 kV in the undriven transmit condition and 1·9 kV with full tone modulation. It should be pointed out to the unwary that due to the high impedance bleed resistor on the main electrolytics the e.h.t. took 64 seconds to fall to 100 volts when the mains supply was disconnected. Another result of the low bleed current is that the d.c. voltage across the electrolytics was unbalanced. With 240 volts a.c. input the voltages varied from 370 to 460 volts d.c. across 450 volt electrolytics. This is very unsatisfactory and there appears to be little that can be done about it. If the bleed current were raised, the transformer would probably be over-run; there is no space for the two additional electrolitics that would be necessary if the bleed current was left as it is.

Handbooks

The HA14 and HP24 have separate handbooks or assembly manuals as Heathkit prefer to term them. These are excellent and contain a wealth of information as well as precise and lucid assembly instructions. One circuit error involving the bifilar wound heater choke was found in the HA14 handbook.

MANUFACTURER'S TECHNICAL SPECIFICATIONS

HA14

Bands Covered:	80, 40, 20, 15 and 10m.
Maximum Power Input:	S.s.b.: 1000 watts p.e.p.
Driving Power Required:	100 watts.
Duty Cycle:	S.s.b.: 50 per cent voice modulation.
Third Order Distortion:	−30db or better at 1000 watts p.e.p.
Output Impedance:	50–75 ohms unbalanced, s.w.r. not to exceed 2 : 1.
Input Impedance:	52 ohms unbalanced; broadband pretuned input circuit requires no tuning.
Meter Functions:	0–6 relative power. 1 : 1 to 3 : 1 s.w.r.
Front Panel Controls:	TUNE: 80, 40, 20, 15 and 10m. BAND: 80, 40, 20 15 and 10m. RELATIVE POWER SENSITIVITY Meter switch F.W.D. and S.W.R. Power switch: OFF, ON.
Valve Complement:	Two 572-B (or two T160-L) in parallel.
Power Requirements:	2000 volts d.c. at 500 mA s.s.b. peak, −120 volts d.c. at 60 mA, and 12·6 volts d.c.* at 4 amps.
Cabinet Size:	12 $\frac{3}{16}$ in. wide × 3 $\frac{3}{16}$ in. high × 10 in. deep.
Net Weight:	7 lb.

HP24

High Voltage:	2500 volts d.c. maximum with no load. 2000 volts d.c. at 300 mA. 1900 volts d.c. minimum at 500 mA.
Effective Output Capacitance:	21 μF.
Ripple:	Less than 1 per cent at 500 mA.
Duty Cycle:	S.s.b.: 50 per cent at 500 mA peak; normal voice operation. C.w.: 33 per cent at 500 mA; normal telegraphy operation.
Bias Voltage:	−180 volts d.c. with no load. −120 volts d.c. at 60 mA.
Duty Cycle:	Continuous at 40 milliamperes.
A.L.C. Threshold Voltage:	Approximately 6 volts d.c.
Filament Voltage:	12·6 volts a.c. at 4 amps.
Power Requirements:	120 volts 60 c/s, a.c. at 16 amps (maximum). 240 volts 60 c/s, a.c. at 8 amps (maximum).
Dimensions:	9 in. long × 4$\frac{3}{4}$ in. wide × 6$\frac{3}{4}$ in. high.
Net Weight:	18$\frac{1}{2}$ lb.

Daystrom Ltd. have stated that the HP24 is suitable for use on a 50 c/s mains supply.

* Although the heater requirements are stated as d.c., the power supply in fact supplies a.c.

On the Air

As has been mentioned previously there is no way of determining the d.c. power input to the HA14 amplifier valves. It can be driven to 1·2 kW input before limiting starts, although the specification says 1 kW. The best approach is to work backwards from the power gain figures quoted above and adjust the driver accordingly.

The driver used for air testing was the KW Vespa which conveniently had insufficient power to run the HA14 into limiting, but sufficient to drive it to the legal limit. With only two controls, bandswitch and anode tuning, the HA14 was extremely easy to tune up. The forward power position of the v.s.w.r. meter was used to indicate resonance. Listener reports indicated that the extra power was well worthwhile and that there was no difference in audio quality.

The duty cycle is of some importance in a compact unit. Heathkit say 50 per cent voice modulation on s.s.b. Just what this statement means is not clear. With the KW Vespa as a driver, the heat rise during transmit periods was reasonable. During the bench tests the heat rise was very high, which is only to be expected when well over 500 watts is dissipated in 290 cubic inches, and the unit had to be externally blower cooled for test purposes.

TVI

The HA14 was checked on 40, 20, 15 and 10m under the same conditions as the KW Vespa reviewed in the May issue of the RSGB BULLETIN. There was no sign of parasitics under any drive condition and although TVI occurred on 20, 15 and 10m, it was due to swamp signal from the HA14. A simple high pass filter in the television feeder cleared the interference.

Warranty

The units are warranted for three months from date of purchase. The warranty is not transferable and outside the USA is on a factory f.o.b. basis.

Conclusions

The main thing about the HA14 is that it works. It is an attractive low cost device, but in the terminology of the sports car enthusiast, is very "hairy." There is a more sophisticated alternative, however. The Heathkit SB200 is almost identical to the HA14 and HP24 combination in circuitry but has built in grid and anode current metering. It also has a better engineered reflectometer, an output loading control and a cooling fan.

India's YLs

According to Louisa B. Sando, W5RZJ, YL Editor of *CQ Magazine*, there are at least half a dozen active YL amateurs in India with another half a dozen well on the way to a licence. The active group include VU2EV, LA, LD and YL, the latter being the wife of Col King, VU2AK. VU2QFZ and 2LYZ are Grade II Novice Licence holders; YU2EV and YU2LD are electronic engineers. YU2LA was recently chosen "Bangalore Ham of the Year" and received a citation for contributions to the local club and to YL activities in India.

The Use of SI Units

A booklet dealing with the use of the metric system in the United Kingdom, entitled *The Use of SI Units*, is available from the Sales Branch, British Standards Institution, 2 Park Street, London, W.1, price 1s. post free.