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TELEVISION KLYSTRONS and accessories

EMI-Varian Limited

EMI-Varian markets a wide range of microwave tubes and associated devices for use in radar, communications and broadcasting systems.

The range includes :

Reflex klystrons.
2-Cavity klystron oscillators.
Backward wave oscillators.
Magnetron oscillators.
Travelling wave tubes.
High and low power klystron amplifiers.
Solid state products.
Microwave components.
Microwave mixer pre-amplifiers.
R.F. amplifiers, converters and components.
I.F. amplifiers and components.
Microstrip circuits.
Strip transmission line components.
Pulse modulation receivers.
Xenon lamps.
Power grid tubes.

Details of all these components and advice on their application and installation are readily available from EMI-Varian's team of specialist marketing engineers. For further information telephone either EMI-Varian or your nearest sales office, a list of which appears on the back cover.

Contents

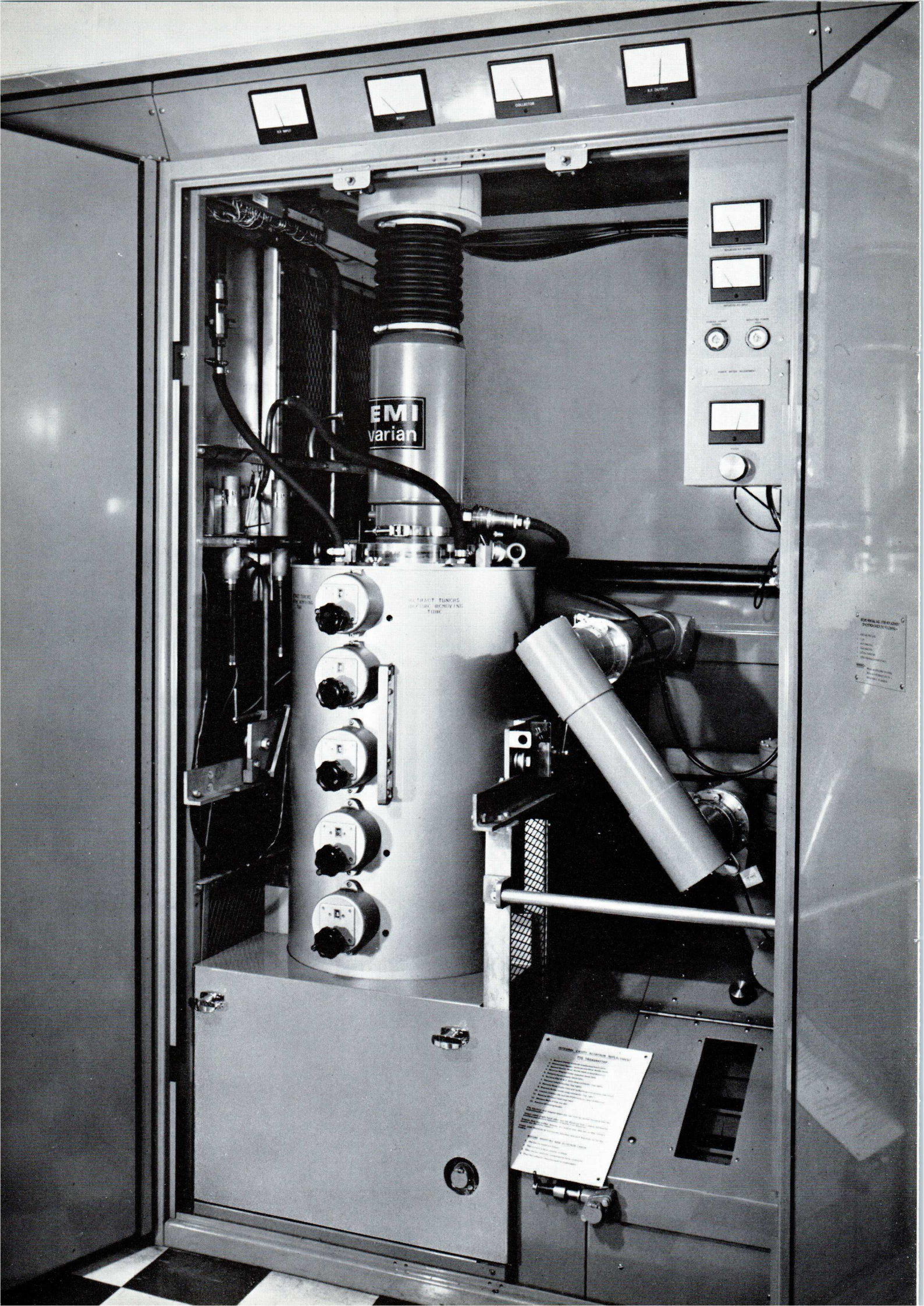
Television Klystrons

EMI-Varian manufactures a range of 10 kW, 25 to 32 kW, 40 kW and 55 kW c.w. klystron amplifiers.

These klystrons are designed for use as the final stage for both sound and vision amplifiers of UHF television transmitters. Within each power level three klystrons cover the frequency range 470–890 MHz.

Features

High power	Up to 55 kW
High gain	40 to 50 dB from five integral cavities.
Low drive	Less than 1 W required.
Ample bandwidth	1 dB bandwidth is at least 8 MHz over the entire tuning range.
Simple installation	Each klystron will be supplied factory tuned to any desired channel. No external cavities or dressing required.
Vapour phase cooling	Reduces equipment size and cost.
Long life	Rugged impregnated cathode and an integrated Vacion® pump together ensure a long operating life.
Integral cavities	The r.f. cavities form part of the vacuum envelope giving inherent qualities of ruggedness and reliability. The design construction of the electromagnet is also simplified. This leads to a competitive klystron-electromagnet package cost.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Why Integral Cavities?

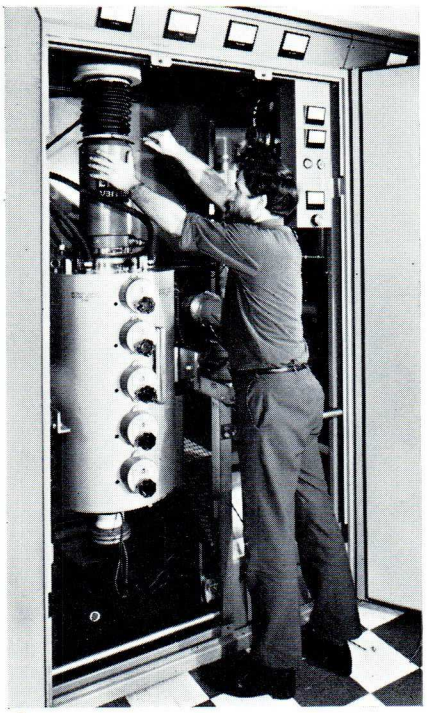
With the cavities part of the vacuum envelope many ceramic to metal seals and external sliding contacts are eliminated. The integral cavity klystron is therefore rugged and reliable.

Problems of r.f. leakage are eliminated. This prevents regeneration and self oscillation and enables power levels of up to 55 kW to be obtained with high gain and good frequency stability. Because of the very high gain of these klystrons, solid state drivers can be used.

Handling has been simplified by taking advantage of the rigid construction of the integral cavity klystron to make it self jigging within its magnet. The electromagnet is fitted into the transmitter and can remain part of it. The electromagnet is designed so that it can be rotated to a horizontal position, the klystron may then be loaded from a special trolley. No special hoisting equipment or overhead clearance is necessary. The installation of the klystron, including making the required electrical and cooling connections, takes less than 15 minutes.

The klystrons are supplied pre-tuned to the required channel, so that in general no adjustment is required on installation. Using the single variable control for each cavity the klystron can be retuned to another channel in about ten minutes with standard transmitter station equipment.

Integral cavity klystrons are therefore particularly suitable for unattended stations where remote monitoring is used and only nominal lifting and handling equipment is available.



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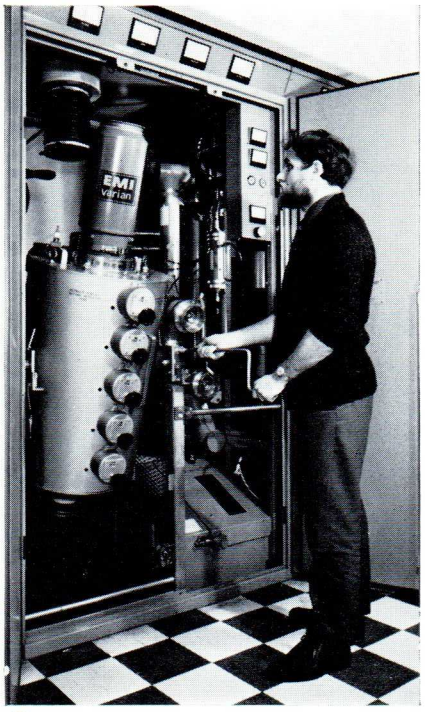

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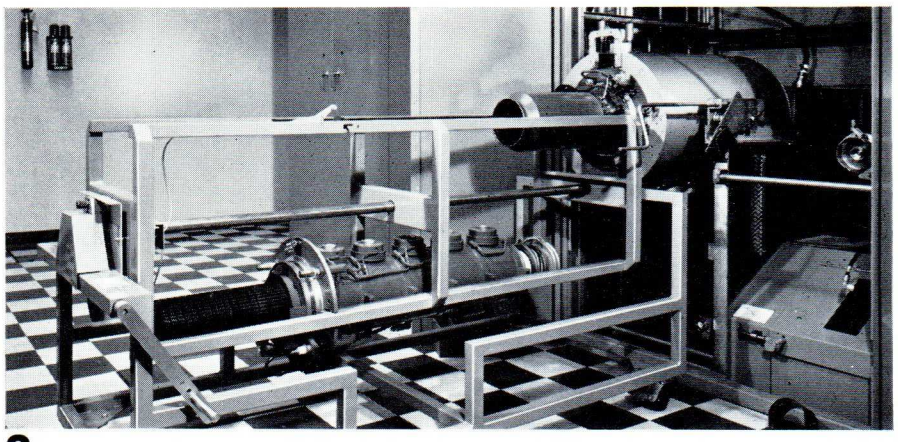

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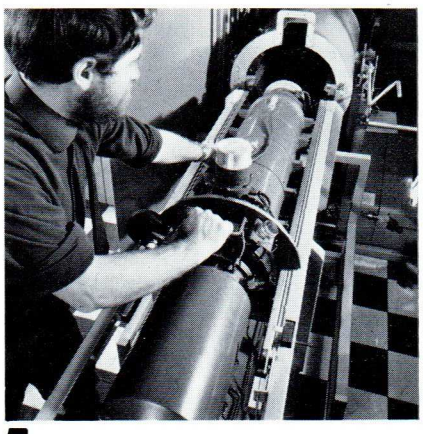

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1 The klystron is first disconnected from the power supplies and cooling system.

2 Still in its electromagnet, the klystron is rotated into a horizontal position.

3 The special trolley containing the new klystron is wheeled into position in front of the electromagnet. The wheels are locked, the old klystron pulled out from the electromagnet, and the output coupler removed.

4 The trolley is rotated to bring the new klystron into position and the output coupler attached.

5 The new klystron is inserted into the electromagnet and the assembly is rotated to a vertical position. As soon as the electrical and cooling connections are replaced, the new klystron is ready for operation.

Klystron amplifiers VA 943B, VA 944B and VA 945B

Description

Frequency range	
VA 943B	470–574 MHz
VA 944B	572–704 MHz
VA 945B	702–860 MHz
Focusing	All three klystrons use VA 1943A electromagnet
Dimensions	See outline drawing
Weights	
VA 943B	114 kg
VA 944B	102 kg
VA 945B	98 kg
VA 1943A	322 kg
Mounting position	Cathode down
Input	Type N, 50 ohm, coaxial panel jack
Output	$3\frac{1}{8}$ inch, 50 ohm, coaxial line
Cooling	
Minimum collector water flow	2 L/min
Minimum body and magnet air flow	3 m^3/min
Air pressure drop at minimum flow	13 cm H_2O
Minimum cathode air flow	1·5 m^3/min

Typical operating conditions[1] and performance as a vision amplifier

Klystron output power, peak sync.	12·5 kW
Drive power for peak sync.	610 mW peak
Gain at peak sync.	43 dB
Efficiency[2]	39%
1 dB bandwidth	8 MHz
Cathode voltage	−12·2 kV d.c.
Heater voltage	5 V
Heater current	15 A
Beam current	2·63 A
Body current	14 mA
Modulating anode voltage	Body potential
Modulating anode current	1·5 mA
Collector temperature[3]	105°C
Electromagnet voltage	45 V d.c.
Electromagnet current	10 A

Notes

1 Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

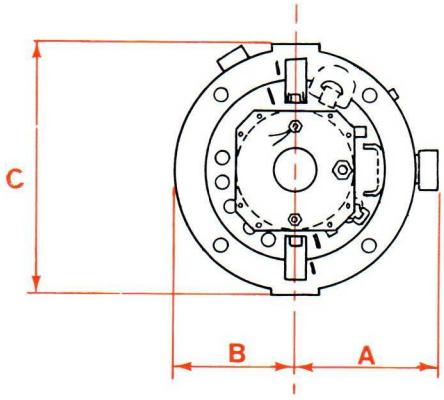
2 Efficiency at 12·5 kW output power.

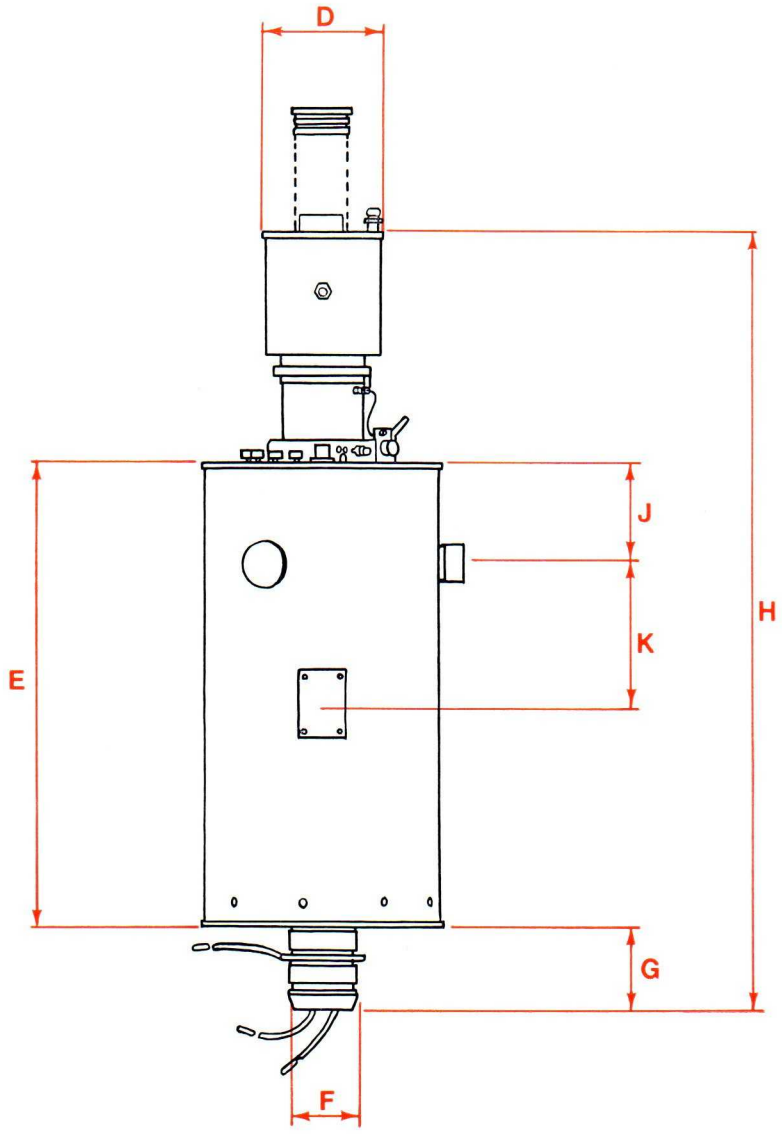
3 The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

Outline drawing of VA 943B in VA-1943A electromagnet

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA943B	286	257	533	257	813	118	140	1400	173	221
VA944B	286	257	533	257	813	118	140	1400	173	221
VA945B	286	257	533	257	813	118	140	1400	173	221

Dimensions are in millimetres





Klystron amplifiers VA 946A, VA 947A and VA 948A

Description

Frequency range	
VA 946A	470–566 MHz
VA 947A	566–698 MHz
VA 948A	694–890 MHz
Focusing	
VA 946A requires electromagnet	VA 1950A
VA 947A requires electromagnet	VA 1951A
VA 948A requires electromagnet	VA 1952A
Dimensions	See outline drawing
Weights	
VA 946A	156 kg
VA 947A	135 kg
VA 948A	96 kg
VA 1950A	272 kg
VA 1951A	227 kg
VA 1952A	170 kg
Mounting position	Cathode down
Input	Type N, 50 ohm, coaxial panel jack
Output	$3\frac{1}{8}$ inch, 50 ohm, coaxial line
Cooling	
Minimum collector water flow	6 L/min
Minimum body water flow	7·5 L/min
Minimum electromagnet water flow	7·5 L/min
Maximum body water pressure drop at 7·5 L/min	275 kN/m²
Maximum electromagnet water pressure drop at 7·5 L/min	240 kN/m²
Maximum water inlet temperature[4]	70°C
Minimum cathode air flow	1·5 m³/min
Typical operating conditions[1] and performance as a vision amplifier	
Klystron output power, peak sync.	32 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	49 dB
Efficiency[2]	32%
1 dB bandwidth	8 MHz
Cathode voltage	−19 kV d.c.
Heater voltage	7·5 V
Heater current	18 A
Beam current	5·3 A
Body current	20 mA
Modulating anode voltage	Body potential
Modulating anode current	1·5 mA
Collector temperature[3]	105°C
Electromagnet voltage	110 V d.c.
Electromagnet current	30 A

Notes

1 Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

2 Efficiency at 32 kW output power.

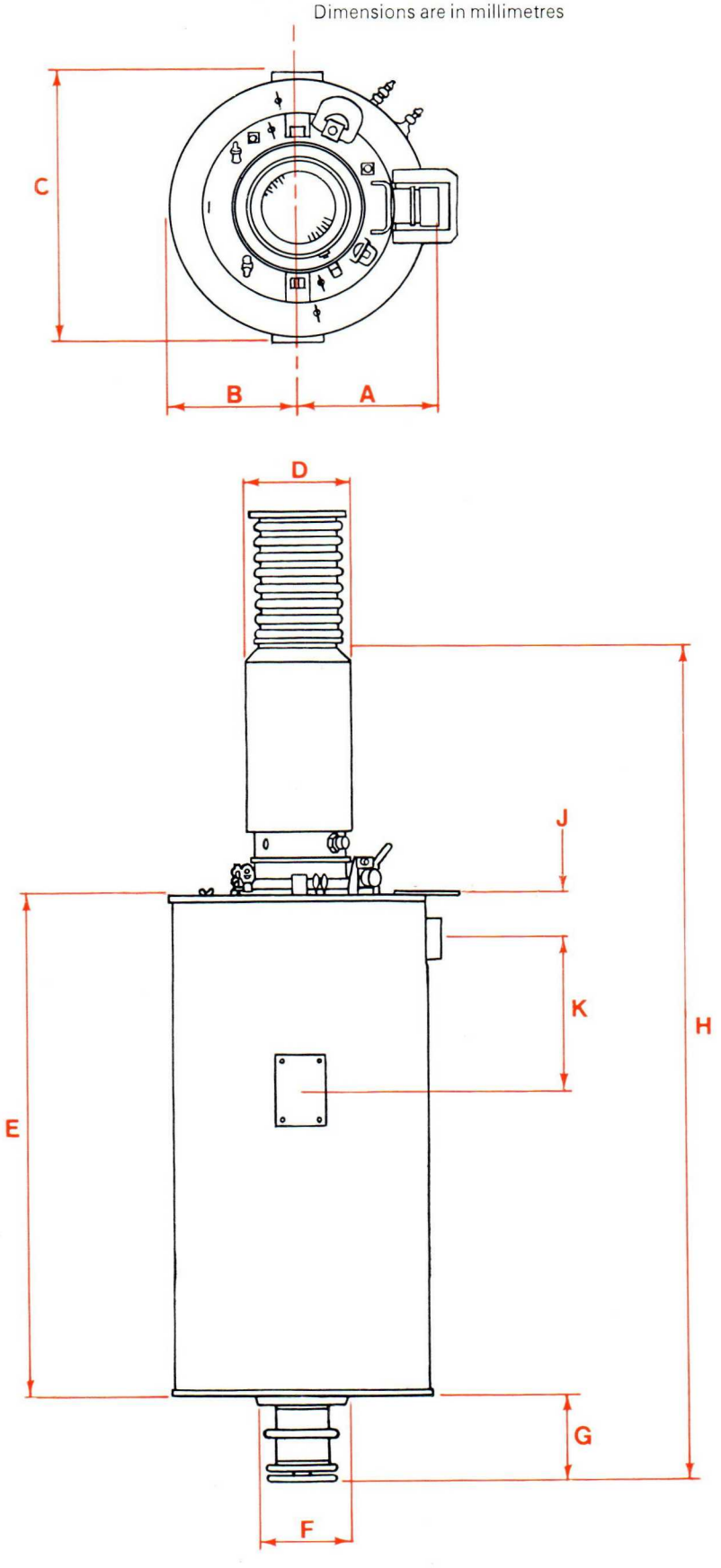
3 The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

4 For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

Outline drawing of VA 946A in VA-1950A electromagnet

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA946A/G	286	257	533	205	991	191	194	1700	79·4	184
VA947A/G	286	257	533	205	813	191	194	1529	79·4	184
VA948A/G	286	257	533	205	605	191	194	1321	76·2	143

Dimensions are in millimetres



Klystron amplifiers VA 950A, VA 951A and VA 952A

Description

Frequency range	
VA 950A	470–566 MHz
VA 951A	566–698 MHz
VA 952A	694–890 MHz
Focusing	
VA 950A requires electromagnet	VA 1950A
VA 951A requires electromagnet	VA 1951A
VA 952A requires electromagnet	VA 1952A
Dimensions	See outline drawing
Weights	
VA 950A	177 kg
VA 951A	155 kg
VA 952A	117 kg
VA 1950A	272 kg
VA 1951A	227 kg
VA 1952A	170 kg
Mounting position	Cathode down
Input	Type N, 50 ohm coaxial panel jack
Output	$3\frac{1}{8}$ inch, 50 ohm coaxial line
Cooling	
Minimum collector water flow	8 L/min
Minimum body water flow	10 L/min
Minimum electromagnet water flow	7·5 L/min
Maximum body water pressure drop at 10 L/min	410 kN/m²
Maximum magnet water pressure drop at 7·5 L/min	240 kN/m²
Maximum water inlet temperature[4]	70°C
Minimum cathode air flow	1·5 m³/min
Typical operating conditions[1] and performance as a vision amplifier	
Klystron output power, peak sync.	45 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	51 dB
Efficiency[2]	32%
1 dB bandwidth	8 MHz
Cathode voltage	−22 kV d.c.
Heater voltage	7·5 V
Heater current	18A
Beam current	6·4 A
Body current	32 mA
Modulating anode voltage	Body potential
Modulating anode current	1·5 mA
Collector temperature[3]	110°C
Electromagnet voltage	110 V d.c.
Electromagnet current	30 A

Notes

1 Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

2 Efficiency at 45 kW output power.

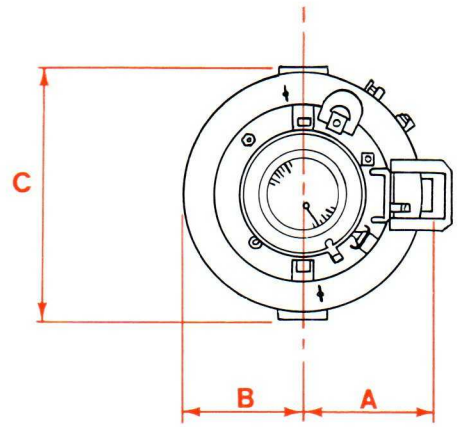
3 The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

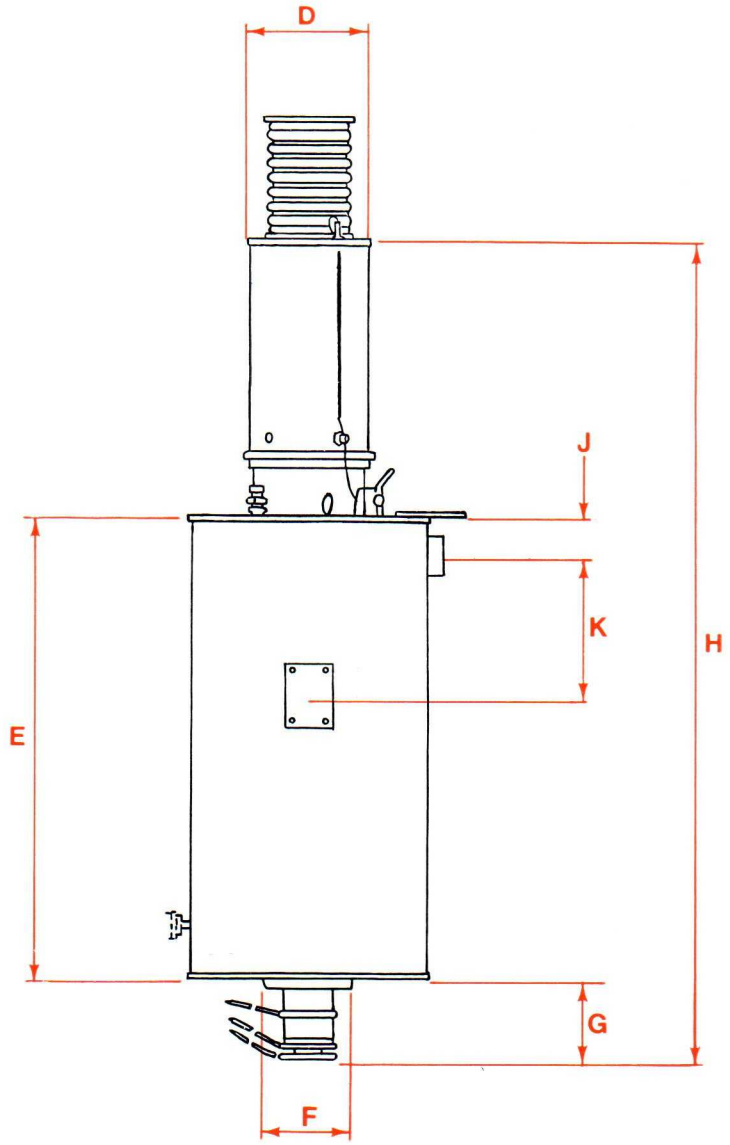
4 For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

Outline drawing of VA 950A in VA-1950A electromagnet

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA950A	286	257	533	256	991	191	210	1815	83	298
VA951A	286	257	533	256	813	191	200	1622	83	298
VA952A	286	257	533	256	605	191	194	1414	76·2	124

Dimensions are in millimetres





Klystron amplifiers[5] VA 953A/B, VA 954A/B and VA 955A/B

Description

Frequency range	
VA 953A/B	470–566 MHz
VA 954A/B	566–698 MHz
VA 955A/B	694–890 MHz
Focusing	
VA 953A/B require electromagnet	VA 1950A
VA 954A/B require electromagnet	VA 1951A
VA 955A/B require electromagnet	VA 1952A
Dimensions	See outline drawing
Weights	
VA 953A/B	177 kg
VA 954A/B	155 kg
VA 955A/B	117 kg
VA 1950A	272 kg
VA 1951A	227 kg
VA 1952A	170 kg
Mounting position	Cathode down
Input	Type N, 50 ohm, coaxial panel jack
Output	$3\frac{1}{8}$ inch, 50 ohm, coaxial line
Cooling	
Minimum collector water flow	8 L/min
Minimum body water flow	10 L/min
Minimum electromagnet water flow	7·5 L/min
Maximum body water pressure drop at 10 L/min	410 kN/m²
Maximum electromagnet water pressure drop at 7·5 L/min	240 kN/m²
Maximum water inlet temperature[4]	70°C
Minimum cathode air flow	1·5 m³/min

Typical operating conditions[1] and performance as a vision amplifier

Klystron output power, peak sync.	55 kW
Drive power for peak sync.	400 mW
Gain at peak sync.	51 dB
Efficiency[2]	34%
1 dB bandwidth	8 MHz
Cathode voltage	−23 kV d.c.
Heater voltage	7·5 V
Heater current	18 A
Beam current	7·0 A
Body current	35 mA
Modulating anode voltage	Body potential
Modulating anode current	1·5 mA
Collector temperature[3]	120°C
Electromagnet voltage	110 V
Electromagnet current	30 A

Notes

1 Characteristics and operating values are based on performance tests. These figures may be changed without notice as a result of additional information or product improvement. EMI-Varian Limited should be consulted before using this information for equipment design.

2 Efficiency at 55 kW output power.

3 The collector temperature is monitored by a thermocouple attached to the collector of each klystron.

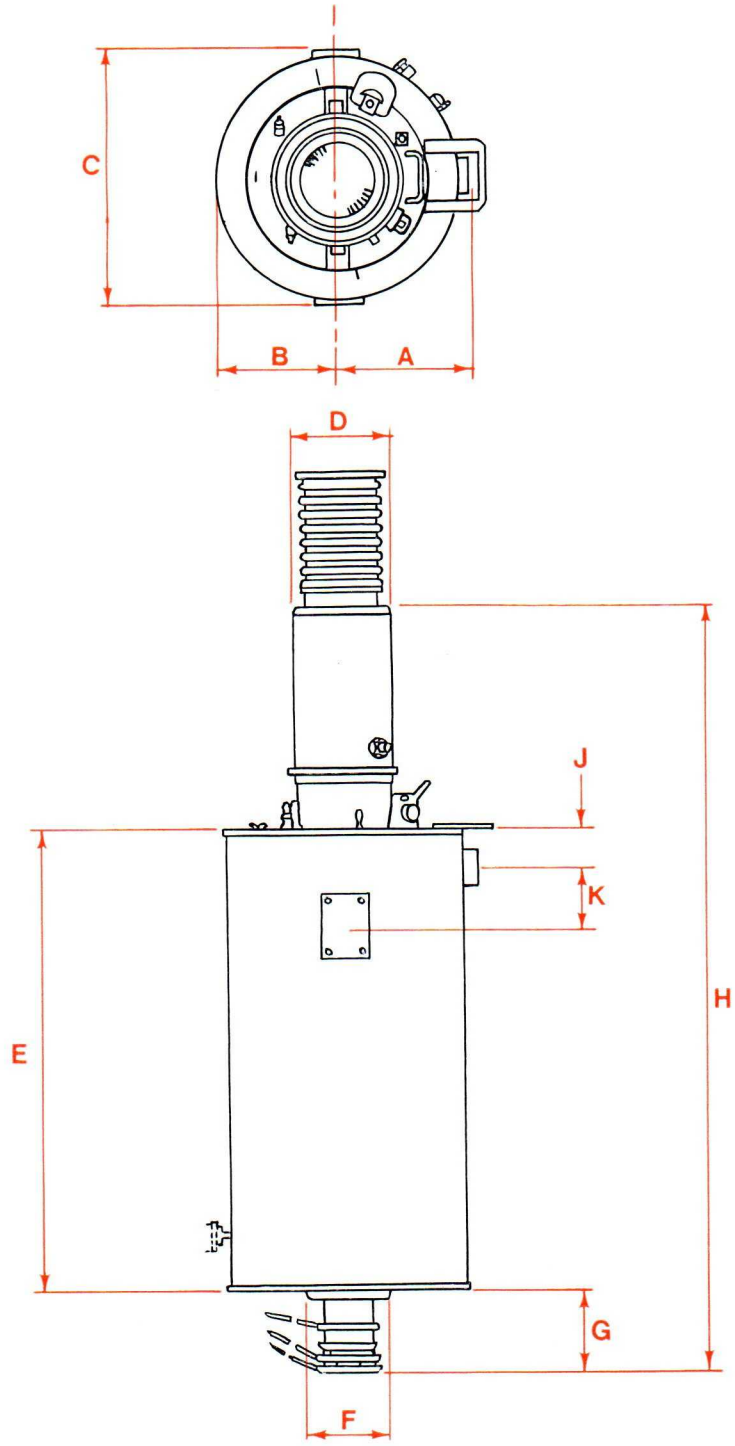
4 For optimum performance the water inlet temperature should be maintained within 5°C of the coolest practicable value.

5 The A and B suffixes distinguish between certain mechanical interface configurations detailed in the specification drawings. There is no difference in either electrical parameters or performance.

Outline drawing of VA 953 A/B in VA-1950A electromagnet

DIMENSIONS	A	B	C	D	E	F	G	H	J	K
VA953A/B	286	257	533	256	991	191	210	1815	83	298
VA954A/B	286	257	533	256	813	191	200	1622	83	298
VA955A/B	286	257	533	256	605	191	194	1414	76·2	124

Dimensions are in millimetres



Accessory kits

The following accessory kits are offered to customers to facilitate the installation and operation of EMI-Varian klystrons. Always state the klystron or electromagnet type when ordering.

Klystron trolley

A klystron loading trolley can be provided to suit customer's requirements.

Output couplers

Separate coaxial output couplers are available for sound and vision operation. One sound and one vision coupler will be supplied with each electromagnet. When ordering spares always state the frequency for which the coupler is required and whether it is for sound or vision operation.

Special tuner sets with tuner counters

For easy tuning a special tuner set with counters is available. This simplifies re-setting to pre-determined positions.

Steam separator and water level interlock

These accessories can be provided to fit the 25 kW, 40 kW and 55 kW klystrons and, when installed as a pair,

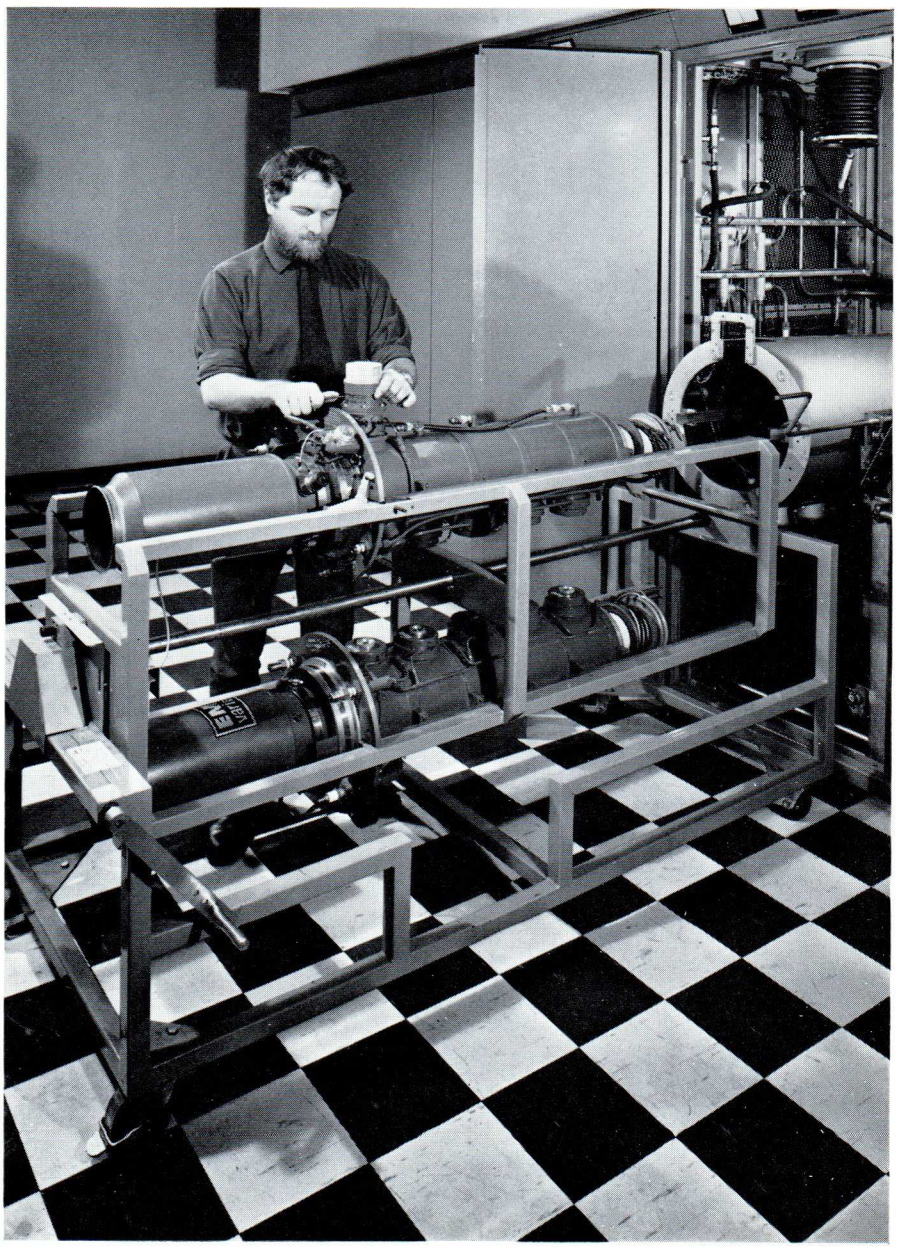
a control the water level so that the collector is properly immersed.

b provide a water level interlock.

c separate water from steam.

In-line weir

This weir has been specially designed for the 10 kW klystrons, and performs the functions both of steam separator and of water level interlock.



The output coupler being fitted onto a klystron. The klystron trolley, the flexible steam pipe connection and the water fittings are all clearly shown.

Adaptor kits

These kits contain all the parts needed for making the r.f. connection between the klystron output coupler and a $3\frac{1}{8}$ inch coaxial line, and also include all the mating parts required for the electrical, water and steam interface connections.

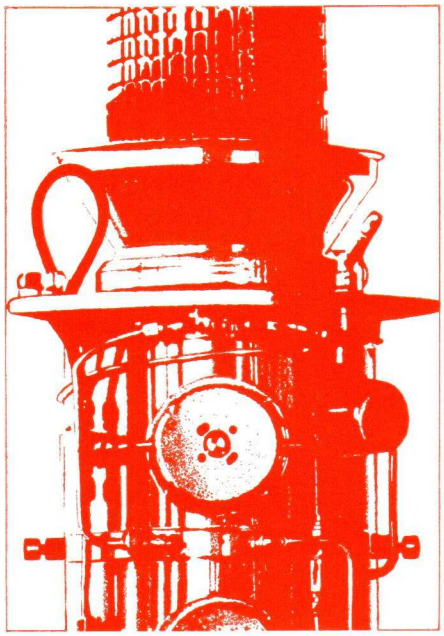
Kit BAK 104 contains the parts required for the 10kW klystrons. Kit BAK 105 contains the part required for the 25kW, 40kW and 55kW T/V klystrons.

Adaptor kit BAK-105

Item	Drawing No.	Description	Quantity
1	049175 N	Hansen Socket LL6–H 31	1
2	049195 N	Hose connector $\frac{1}{2}$" MPT LLS 26	1
3	049174 N	Hansen socket LL3–H21	4
4	049178 N	Hose connector $\frac{3}{8}$" MPT LLS 24	4
5	047745 N	Cable RG 108 A/U	96 in.
6	047931 N	Rubber boot	1
7	047999 N	Bushing AN 3420–12	1
8	048028 N	Plug MS 3106A–22–4S	1
9	048087 N	Arc sensors connector Amph 31–224	1
10	048112 N	Boot clamp	2
11	048124 N	Cannon plug CA 06 AQ 24–20S–F 9–A 105	1
12	049196 N	Bushing $\frac{1}{2}$ FPT × $\frac{3}{4}$ MPT	1
13	072250 N	Input connector UG 21 D/U	1
14	072479 N	Cable clamp AN 3057–16	1
15	072575 N	Cable clamp MS 3057 A–12	1
16	047138 N	Hose clamp M 48	2
17	A 181607	Inner conductor adaptor	1
18	072650 N	H.V. connector cable assembly RG–59/U	1
19	072721 N	Garter spring Vac-ion	1
20	A 184679	Load coupler sleeve	1

Adaptor kit BAK-104

Item	Drawing No.	Description	Quantity
1		Hansen LL4–H26–192	1
2	049195 N	Hose connector $\frac{1}{2}$" MPT LLS 26	1
3	047745 N	Cable RG 108 A/U	96 in.
4	048330 N	Rubber boot	1
5	047999 N	Bushing AN 3420–12	1
6	048028 N	Plug MS 3106 A–22–4S	1
7	048087 N	Arc sensors connector Amph 31–244	1
8	048145 N	Boot clamp H 60 SS	2
9	048124 N	Cannon plug CA 06 AQ 24–20S–F9–A 105	1
10	072250 N	Input connector UG–21 D/U	1
11	072479 N	Cable clamp AN 3057–16	1
12	072575 N	Cable clamp MS 3057 A–12	1
13	047138 N	Hose clamp M 48	2
14	A 181607	Inner conductor adaptor	1
15	048064 N	Marman coupling PN 57000–0744–S	1
16	124715 N	"O" Ring Viton 439 $6\frac{1}{2}$" ID × $\frac{1}{4}$" Wall	1
17		H.V. Connector cable assembly 929–0750	1
18	072721 N	Garter spring Vac-ion	1
19	A 184679	Load coupler sleeve	1



TELEVISION KLYSTRONS and accessories

Among other brochures which are available from EMI-Varian Ltd are :

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