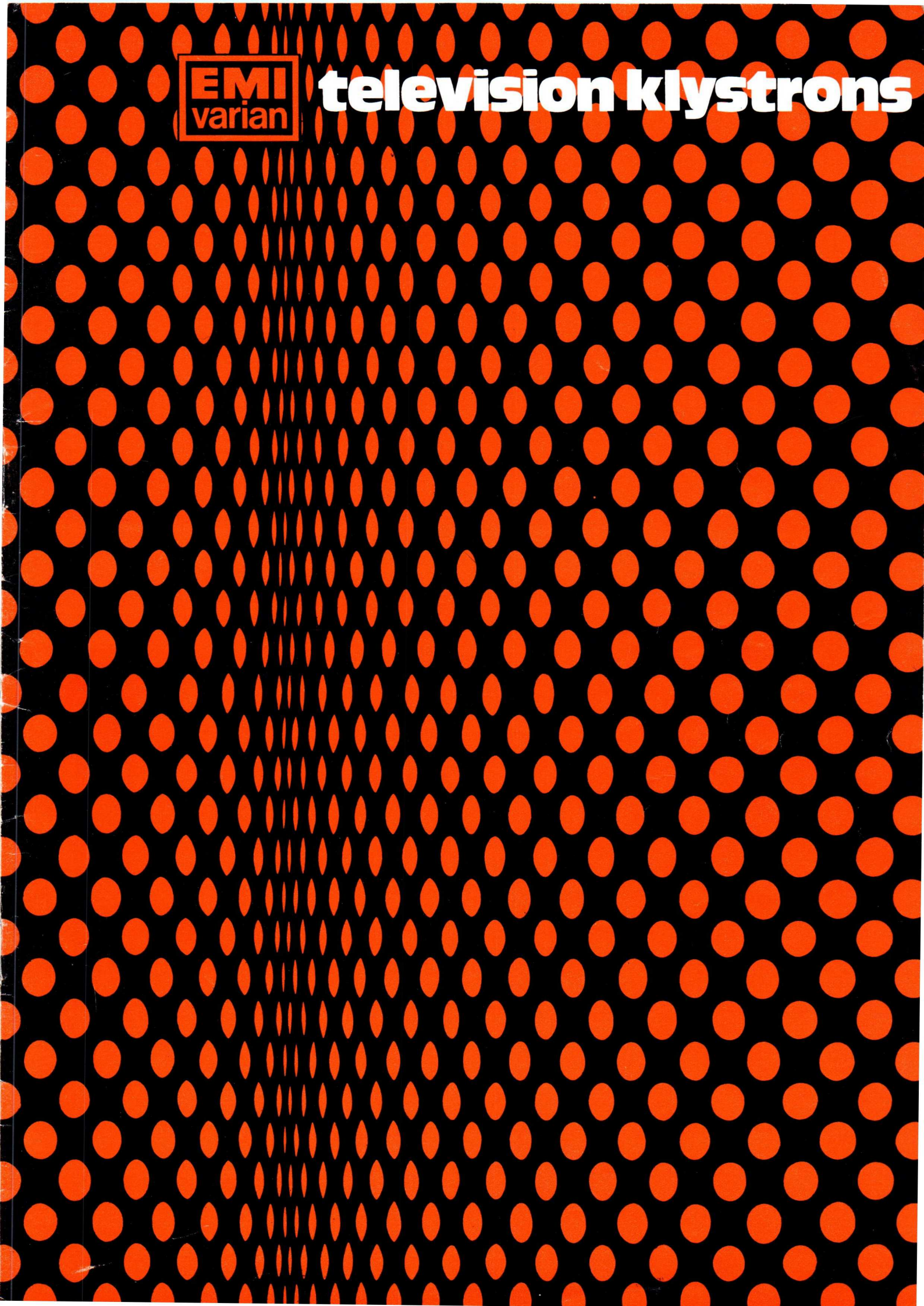




# television klystrons



# EMI Varian Ltd

EMI-Varian Ltd. was formed as a result of an agreement between EMI Ltd. of U.K. and Varian Associates of U.S.A to pool their research, technology and manufacturing resources, with respect to microwave tubes and associated devices.

Both companies have vast experience in microwave and power tubes and associated components and together can offer a wide range of products backed by unrivalled technical know-how.

## **EMI-Varian Ltd., markets in the U.K. the products of the following Divisions of Varian Associates:**

Eastern Tube Division,  
Beverly, Massachusetts.  
Union, New Jersey.  
Eimac Division, San Carlos, California.  
Palo Alto Tube Division, Palo Alto, California.  
TWT Division, Palo Alto California.  
Solid State Division,  
Palo Alto, California.  
Copiague L.I., New York,  
Beverly, Massachusetts.  
National Electronics Inc., Geneva, Illinois.  
Varian of Canada Ltd.

## **Products available from EMI-Varian include:**

Reflex klystrons  
2-Cavity klystron oscillators  
Backward wave oscillators  
Magnetron oscillators  
Crossed-field amplifiers  
Klystron amplifiers  
Travelling wave tubes  
Solid-state products  
Microwave components  
Microwave mixer-preamplifiers  
R.F. amplifiers, converters and components  
I.F. amplifiers and components  
Strip transmission line components  
Pulse modulation receivers  
Ceramic components  
Microwave Design



# television klystrons

EMI-Varian market a range of 10 kW, 25 kW, 40 kW and 55 kW CW klystron amplifiers. The five cavity klystrons are for use as final amplifier tubes in both visual and aural sections of UHF-TV transmitters. Within each power level three different tubes cover the frequency range of 470 to 890 MHz in consecutive segments. The beam control electrode or modulating anode enables each tube to operate in the aural section of the transmitter at reduced output level using the same beam supply as the visual section.

Each tube uses an electromagnet for focusing and is self-centering on its magnet. Installation is simplified by rollers on the tube body which engage tracks in the electromagnet.

## Features

HIGH POWER.

HIGH GAIN at low drive power.

AMPLE BANDWIDTH – One dB bandwidth is at least 8 MHz over the tuning range.

VAPOUR COOLING – Reduces equipment size, noise and cost.

LONG LIFE – Rugged impregnated cathode and on integrated Vacion® pump to maintain a high vacuum, assure long tube life.

SIMPLE INSTALLATION and OPERATION – Each tube can be factory tuned to a specified frequency if desired, but is tunable over its entire frequency range. The electromagnet operates from a single power supply.

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# CW klystron amplifiers VA 943A, 944A and 945A

## specification

### Features

High Power –

Output in excess of 12,5 kW for reliable, long-life performance.

High Gain –

Gain of at least 43 dB produces an output of 12,5 kW with less than 600 mW of drive power.

Simple Installation and Operation –

Each tube can be furnished factory tuned to a specified frequency if desired, but is tunable over its entire frequency range. The electromagnet operates from a single power supply. Installing the tube is made easy by rollers on the tube which mate with channels in the electromagnet.

### Electrical

Frequency range	470 to 890 MHz
VA-943A	470 to 574 MHz
VA-944A	572 to 704 MHz
VA-945A	702 to 890 MHz
Heater voltage	8 V
Heater current, typical	20 A
Heater warm-up time, min	5 min
Focusing	VA-1943A electromagnet

### Physical

Dimensions	See outline drawings
Weight, max	250 lb
Mounting position	Cathode down
Output	$3\frac{1}{8}$ in 50- $\Omega$ coaxial line
Cooling	Water vapour and forced air
Collector water flow, min <sup>4</sup>	0,4 gal/min
Body and magnet, air flow, min	100 ft <sup>3</sup> /min
Pressure drop, at 100 ft <sup>3</sup> /min	5 in-H <sub>2</sub> O
Cathode air flow, free delivery	50 ft <sup>3</sup> /min

### Operating Conditions and Ratings<sup>1,2</sup>

	Typical Operation	Maximum Ratings
Frequency, visual	635 MHz	
Klystron output, saturated	12,6 kW	
Klystron output, peak-of-sync <sup>3</sup>	10,5 kW	
Drive power, peak-of-sync	330 mW	
Gain, peak-of-sync	45 dB	
Efficiency, saturated	37 %	
Efficiency, peak-of-sync	31 %	
Bandwidth, 1 dB	8 MHz	
Beam voltage	12,5 kV d.c.	13 kV d.c.
Beam current	2,7 A d.c.	3,1 A d.c.
Body current	18 mA d.c.	75 mA d.c.
Modulating anode voltage	12,5 kV d.c.	13 kV d.c.
Modulating anode current	2 mA d.c.	5 mA d.c.
Focusing current	11 A d.c.	00 A d.c.
Load VSWR, operating	—	1,1 : 1
Load VSWR, non-destructive	—	1,5 : 1
Collector temperature	105°C	145°C

### 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 should be consulted before using this information for equipment design.

2. Ratings should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at more than one rating may damage the tube. Equipment design should limit voltage and environmental variations so that the ratings will never be exceeded.

3. With pre-emphasized drive power applied.

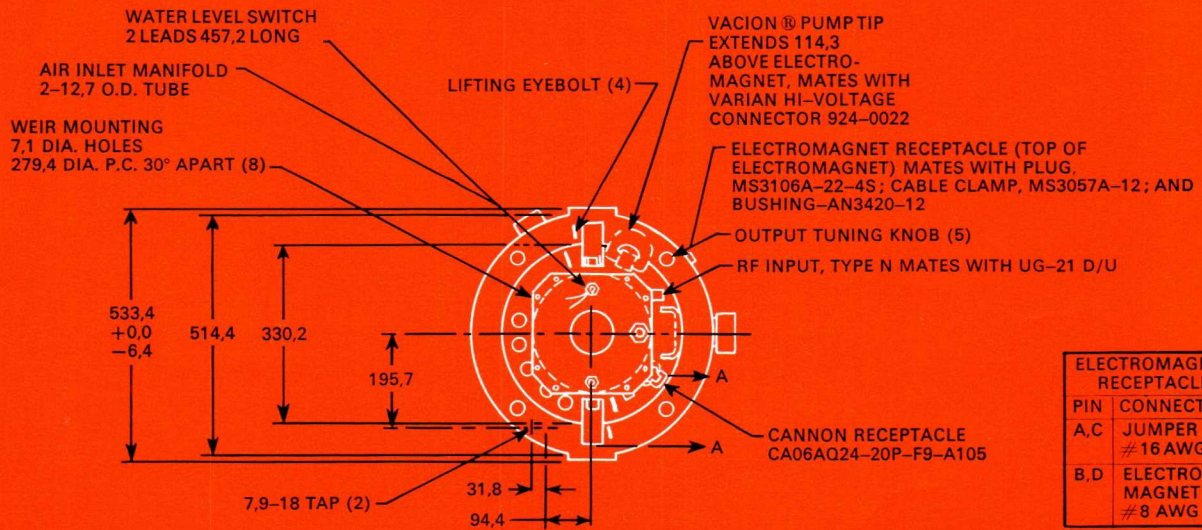
4. The collector temperature is monitored by the chromel-alumel thermocouple attached to each tube at the point indicated on the outline drawing. Typical collector make-up water flow is 0,4 gal/min, although this may vary according to the cooling system used. Final criterion is complete coverage of the collector body during operation.

### Electromagnet VA-1943A

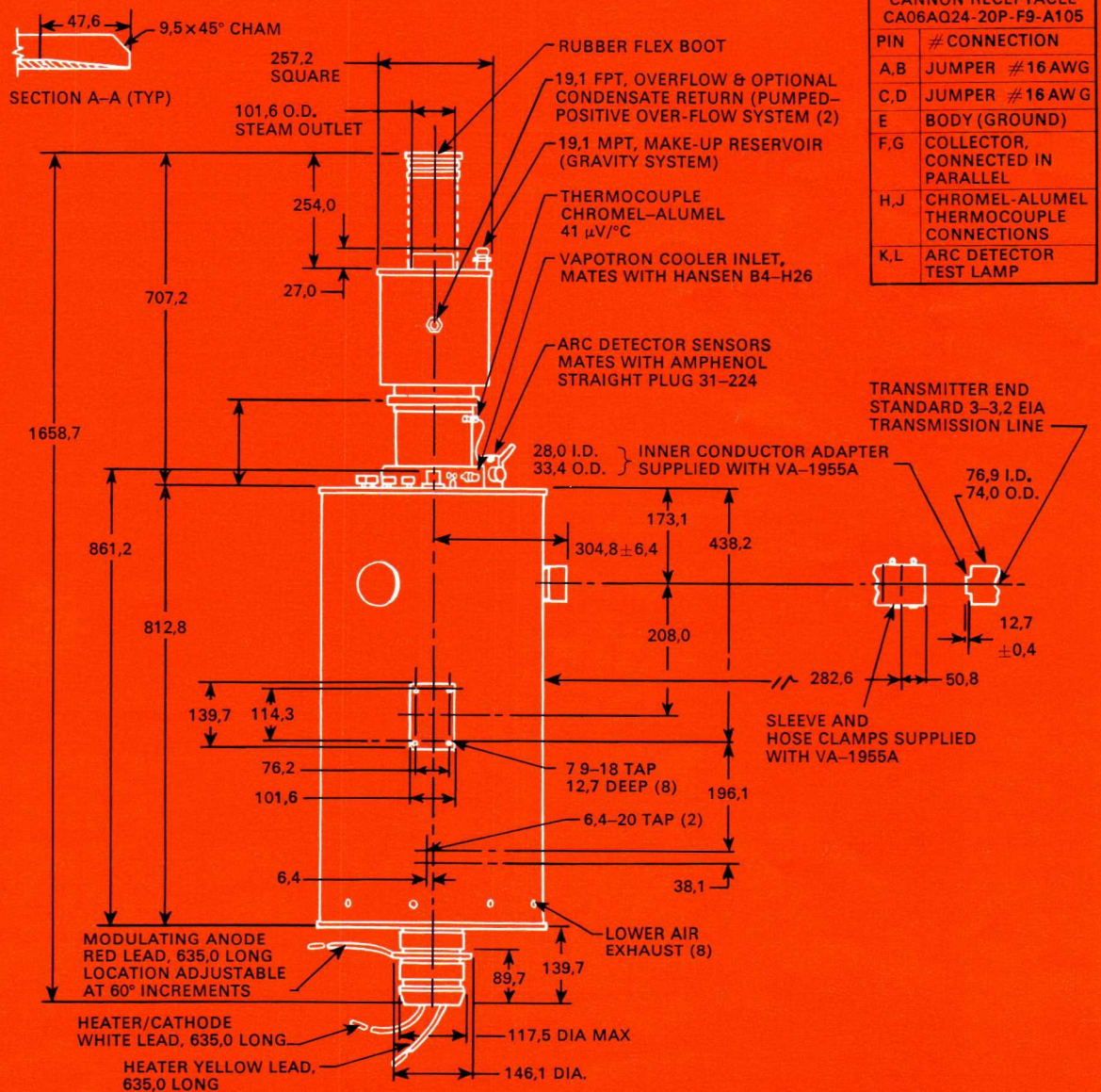
Total power, maximum	
Voltage	100 V d.c.
Current	15 A d.c.
Dimensions	20,25 dia. $\times$ 32 in
Weight, maximum	800 lb



# outline drawing of VA943A, 944A or 945A in VA-1943A electromagnet



ELECTROMAGNET RECEPTACLE	
PIN	CONNECTION
A,C	JUMPER #16 AWG
B,D	ELECTRO- MAGNET #8 AWG



CANNON RECEPTACLE CA06AQ24-20P-F9-A105	
PIN	# CONNECTION
A,B	JUMPER #16 AWG
C,D	JUMPER #16 AWG
E	BODY (GROUND)
F,G	COLLECTOR, CONNECTED IN PARALLEL
H,J	CHROMEL-ALUMEL THERMOCOUPLE CONNECTIONS
K,L	ARC DETECTOR TEST LAMP



# CW klystron amplifiers VA 946C, 947C and 948C

## specification

### Features

#### High Power –

Up to 32,5 kW peak-of-sync visual output and 7 kW aural output for reliable, long-life performance.

#### High Gain –

Gain of at least 45 dB produces an output of 32,5 kW with less than 1 W of drive power.

#### Simple Installation and Operation –

Each tube can be furnished factory tuned to a specified frequency if desired, but is tunable over its entire frequency range. The electromagnet operates from a single power supply. Installing the tube is made easy by rollers on the tube which mate with channels in the electromagnet.

### Electrical

Frequency range	470 to 890 MHz
VA-946C	470 to 566 MHz
VA-947C	566 to 698 MHz
VA-948C	694 to 890 MHz
Heater voltage	7,0 to 7,7 V
Heater current, typ.	17 A
Heater warm-up time, min	5 min
Focusing	Electromagnet

### Physical

Dimensions	See outline drawing
Weight, approx.	350 lb
Mounting position	Cathode down
Cooling	Water vapour and forced air
Collector water flow, min.	1,2 gal/min
Body water flow, min.	1,7 gal/min
Body pressure drop, at min. flow, max.	40 lbf/in <sup>2</sup>
Inlet temperature, max. <sup>5</sup>	70°C
Air flow, free delivery	50 ft <sup>3</sup> /min

### Operating Conditions and Ratings<sup>1,2</sup>

	Typical Operation	Maximum Ratings
Frequency, visual	519 MHz	
Output, saturated	37,5 kW	
Output, peak-of-sync	32,5 kW	
Input	105 kW	
Drive power, peak-of-sync	600 mW	
Gain, peak-of-sync	48 dB	
Efficiency, saturated	35,6 %	
Efficiency, peak-of-sync	30,8 %	
Bandwidth, 1 dB	8 MHz	
Beam voltage	19,5 kV d.c.	21 kV d.c.
Beam current	5,4 A d.c.	6,1 A d.c.
Body current	50 mA d.c.	150 mA d.c.
Modulating anode voltage	19,5 kV d.c.	21 kV d.c.
Modulating anode current	1,5 mA d.c.	10 mA d.c.
Focusing current	28 A d.c.	32 A d.c.
Load VSWR	< 1,1 :1	1,5 :1
Collector temperature <sup>4</sup>	105°C	145°C

### Electromagnet VA-1953B, VA-1954A, VA-1955A

Total power, max.	
Voltage	145 V d.c.
Current	32 A d.c.
Dimensions	20,25 dia. × 39 in
Weight, max.	650 lb
Cooling	
Water flow, min.	1,7 gal/min
Inlet temperature, max.	70°C
Pressure drop, at min. flow, max.	35 lbf/in <sup>2</sup>

### Notes

1. Characteristic and operating values are based on performance tests. These figures may be changed without notice as a result of additional data or product refinement. Consult EMI-Varian before using this information for final equipment design.

2. Ratings should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at more than one rating may damage the tube. Equipment design should limit voltage and environmental variations so that the ratings will never be exceeded.

3. Typical operation assumes an 85% peak-of-sync/ power ratio. Other ratios can be used depending upon the degree of linearity required.

4. The collector temperature is monitored by the chromel-alumel thermocouple attached to each tube at the point indicated on the outline drawing.

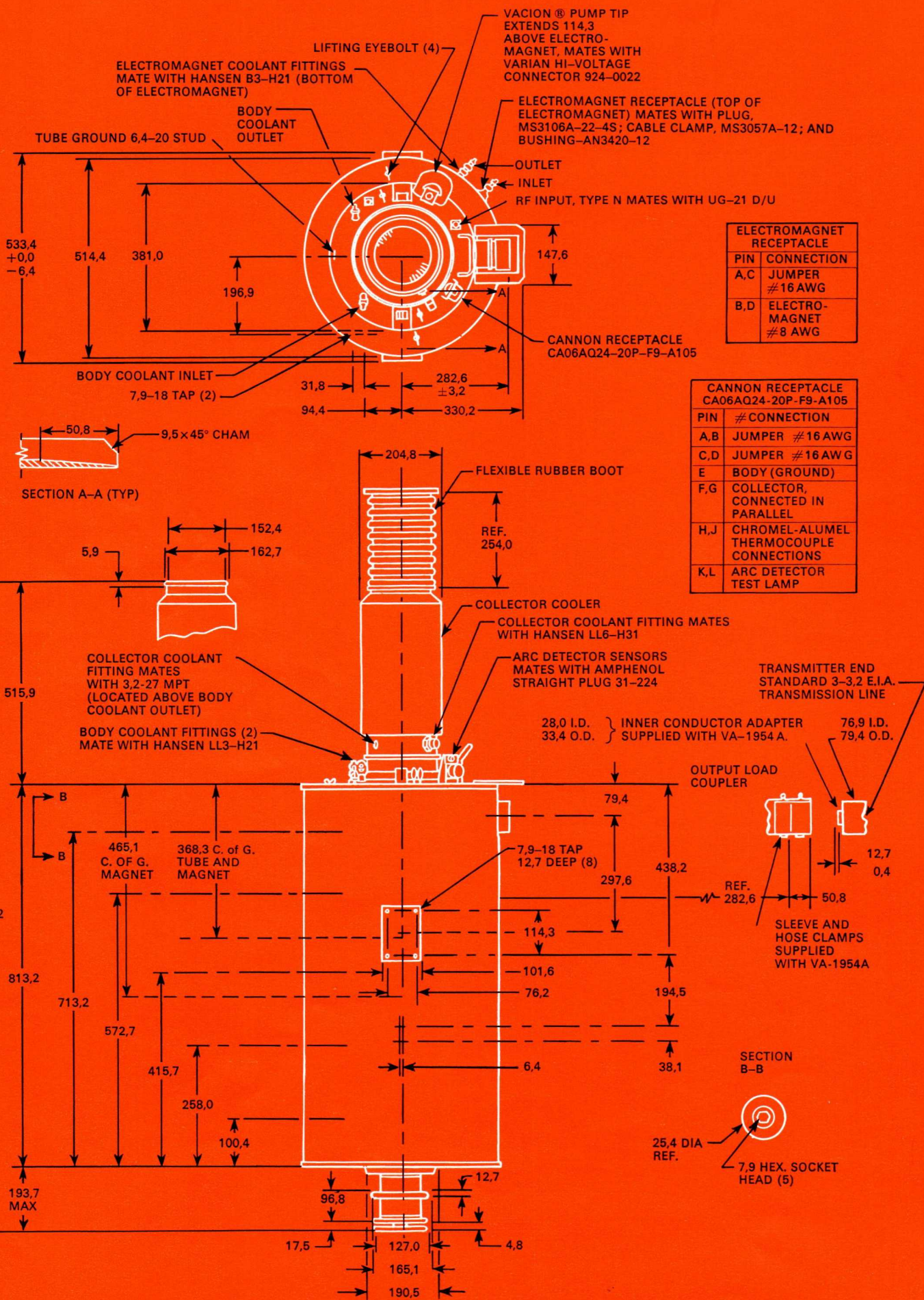
5. For optimum performance, the water inlet temperature should be maintained within 5°C of the coolest practical value.





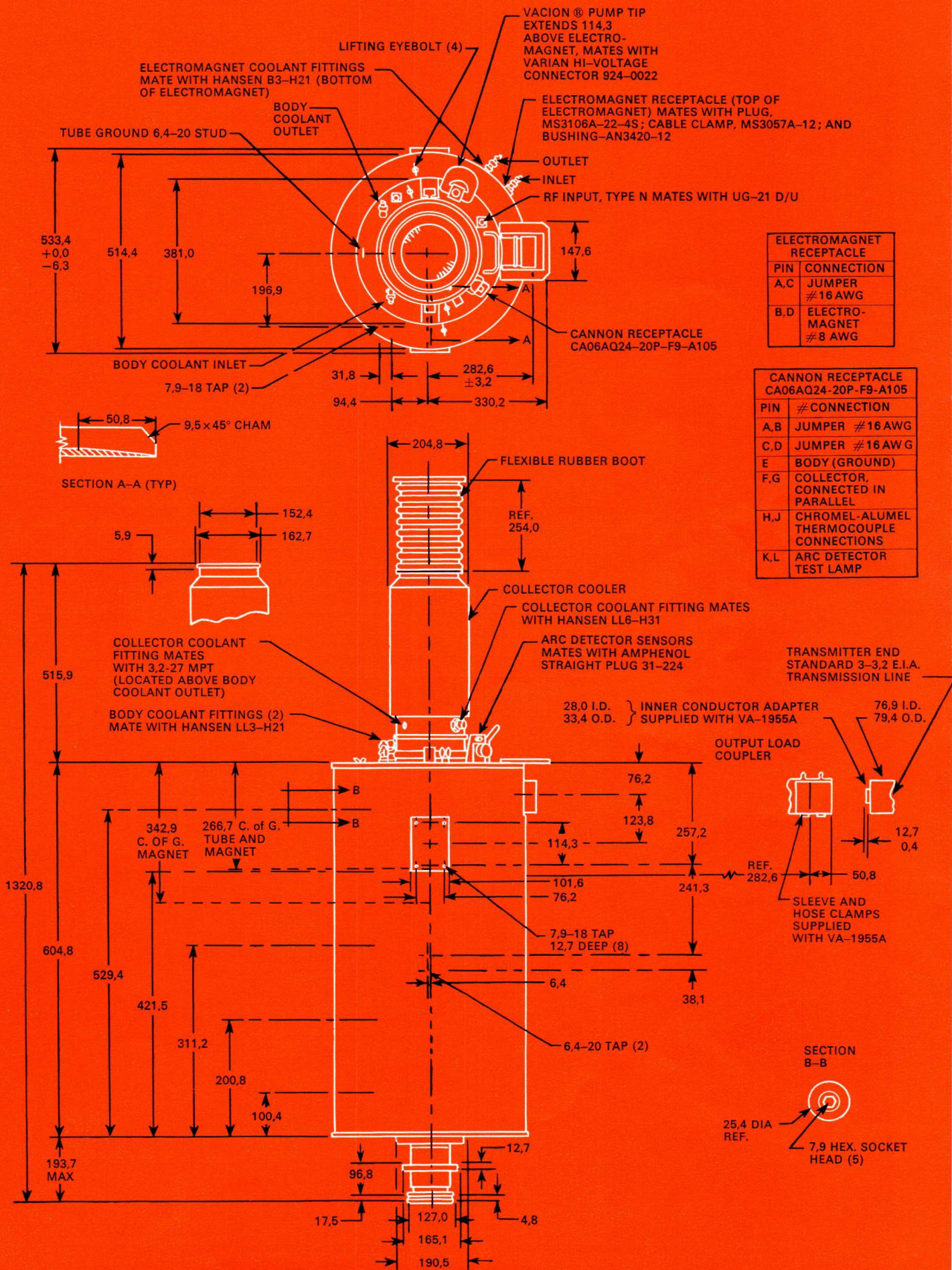


# outline drawing of VA-947 C in VA-1954 A electromagnet





# outline drawing of VA-948C in VA-1955 A electromagnet





# CW klystron amplifiers VA950A, 951A and 952A

## specification

### Features

High Gain –

Output in excess of 40 kW for reliable, long-life performance.

High Gain –

Gain of at least 48 dB produces an output of 40 kW with less than 650 mW of drive power.

Simple Installation and Operation –

Each tube can be furnished factory tuned to a specified frequency if desired, but is tunable over its entire frequency range. The electromagnet operates from a single power supply. Installing the tube is made easy by rollers on the tube which mate with channels in the electromagnet.

### Electrical

Frequency range	470 to 890 MHz
VA-950A	470 to 566 MHz
VA-951A	566 to 698 MHz
VA-952A	694 to 890 MHz
Heater voltage	7,0 to 7,7 V
Heater current, typ.	18 A
Heater warm-up time, min.	5 min
Focusing	Electromagnet

### Physical

Dimensions	See outline drawing
Weight, approx.	240 lb
Mounting position	Cathode down
Cooling	Water vapour and forced air
Collector water flow, min.	1,2 gal/min
Body water flow, min.	2,1 gal/min
Body pressure drop, at min. flow, max.	60 lbf/in <sup>2</sup>
Inlet temperature, max.	70°C
Air flow, free delivery	50 ft <sup>3</sup> /min

### Operating Conditions and Ratings<sup>1,2</sup>

	Typical Operation	Maximum Ratings
Frequency, visual	470 MHz	
Output, peak-of-sync <sup>3</sup>	45 kW	
Drive power, peak-of-sync	600 mW	
Gain, peak-of-sync	48,8 dB	
Efficiency, peak-of-sync	28%	
Bandwidth, 1 dB	8 MHz	
Beam voltage	23 kV d.c.	24 kV d.c.
Beam current	7,0 A d.c.	8,0 A d.c.
Body current	75 mA d.c.	250 mA d.c.
Modulating anode voltage	23 kV d.c.	24 kV d.c.
Modulating anode current	1,5 mA d.c.	10 mA d.c.
Focusing current	28 A d.c.	30 A d.c.
Load VSWR	1,1 :1	1,5 :1
Collector temperature <sup>4</sup>	105°C	145°C

### 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. Consult EMI-Varian before using this information for final equipment design.

2. Ratings should not be exceeded under continuous or transient conditions. A Single rating may be the limitation and simultaneous operation at more than one rating may damage the tube. Equipment design should limit voltage and environmental variations so that the ratings will never be exceeded.

3. With pre-emphasized drive power applied.

4. The collector temperature is monitored by the chromel-alumel thermocouple attached to each tube at the point indicated on the outline drawing.

### Electromagnet VA-1950A, VA-1951A, VA-1952A

Total Power, max.	
Voltage	135 V d.c.
Current	30 A d.c.
Dimensions	20,25 dia × 39 in
Weight, max.	590 lb
Cooling	
Water flow, min.	1,2 gal/min
Inlet temperature, max.	70°C
Pressure drop, at min. flow, max.	25 lbf/in <sup>2</sup>







# CW klystron amplifiers VA953A/B, 954A/B and 955A/B

## specification

### Features

High Power –

Output up to 58 kW for reliable, long-life performance.

High Gain –

Gain of at least 47,6 dB produces an output of 55 kW with less than 1,00 W of drive power.

Simple Installation and Operation –

Each tube can be furnished factory tuned to a specified frequency if desired, but is tunable over its entire frequency range. The electromagnet operates from a single power supply. Installing the tube is made easy by rollers on the tube which mate with channels in the electromagnet.

### Electrical

Frequency range	470 to 890 MHz
VA-953A/B	470 to 566 MHz
VA-954A/B	566 to 698 MHz
VA-955A/B	694 to 890 MHz
Heater voltage	7,0 to 7,7 V
Heater current, typ.	18 A
Heater warm-up time, min.	5 min
Focusing	Electromagnet

### Physical

Dimensions	See outline drawings
Weight, approx.	220 lb
Mounting position	Cathode down
Cooling	Water vapour and forced air
Collector water flow, min.	1,7 gal/min
Body water flow, min.	2,1 gal/min
Body pressure drop, at min. flow, max.	60 lbf/in <sup>2</sup>
Inlet temperature, max.	70°C
Air flow, free delivery	50 ft <sup>3</sup> /min

### Operating Conditions and Ratings<sup>1, 2</sup>

	Typical Operation	Maximum Ratings
Frequency, visual	519 MHz	
Output, peak-of-sync <sup>3</sup>	58 kW	
Drive power, peak-of-sync	700 mW	
Gain, peak-of-sync	49,2 dB	
Efficiency, peak-of-sync	31%	
Bandwidth, 1 dB	8 MHz	
Beam voltage	24 kV d.c.	25 kV d.c.
Beam current	7,8 A d.c.	8,3 A d.c.
Body current	75 mA d.c.	250 mA d.c.
Modulating anode voltage	24 kV d.c.	25 kV d.c.
Modulating anode current	1,5 mA d.c.	10 mA d.c.
Focusing current	30 A d.c.	32 A d.c.
Load VSWR	< 1,1 :1	1,5 :1
Collector temperature <sup>4</sup>	130°C	145°C

### Electromagnet VA-1953A, VA-1954A, VA-1955A

Total Power, max.	
Voltage	150 V d.c.
Current	32 A d.c.
Dimensions	See outline drawings
Weight, max.	590 lb
Cooling	
Water flow, min.	1,7 gal/min
Inlet temperature, max.	70°C
Pressure drop, at min. flow, max.	35 lbf/in <sup>2</sup>

### Notes

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2. Ratings should not be exceeded under continuous or transient conditions. A single rating may be the limitation and simultaneous operation at more than one rating may damage the tube. Equipment design should limit voltage and environmental variations so that the ratings will never be exceeded.

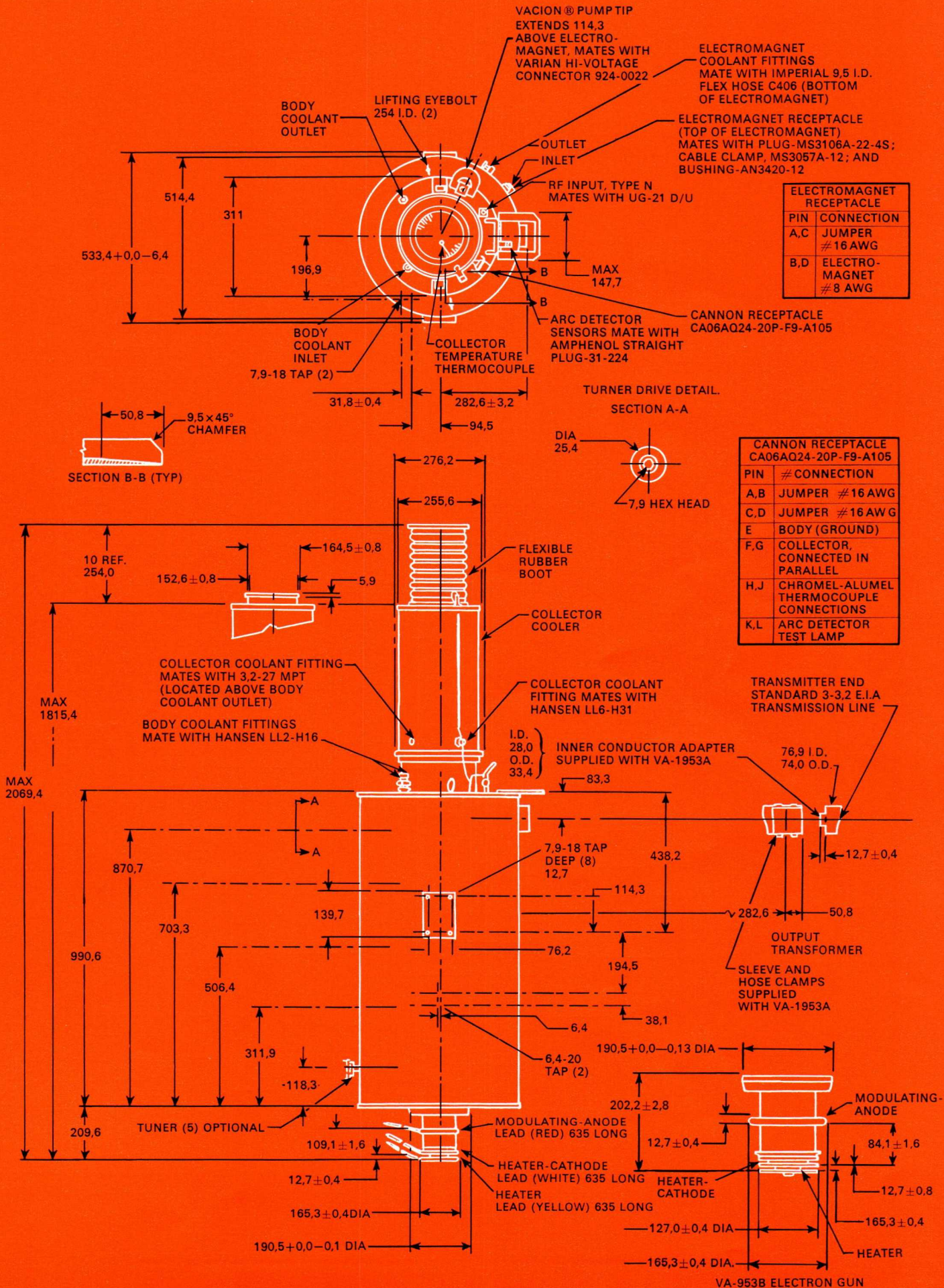
3. With pre-emphasized drive power applied.

4. The collector temperature is monitored by the chromel-alumel thermocouple attached to each tube at the point indicated on the outline drawing.

5. For electromagnet VA-1955A, the maximum current is 30 A d.c.



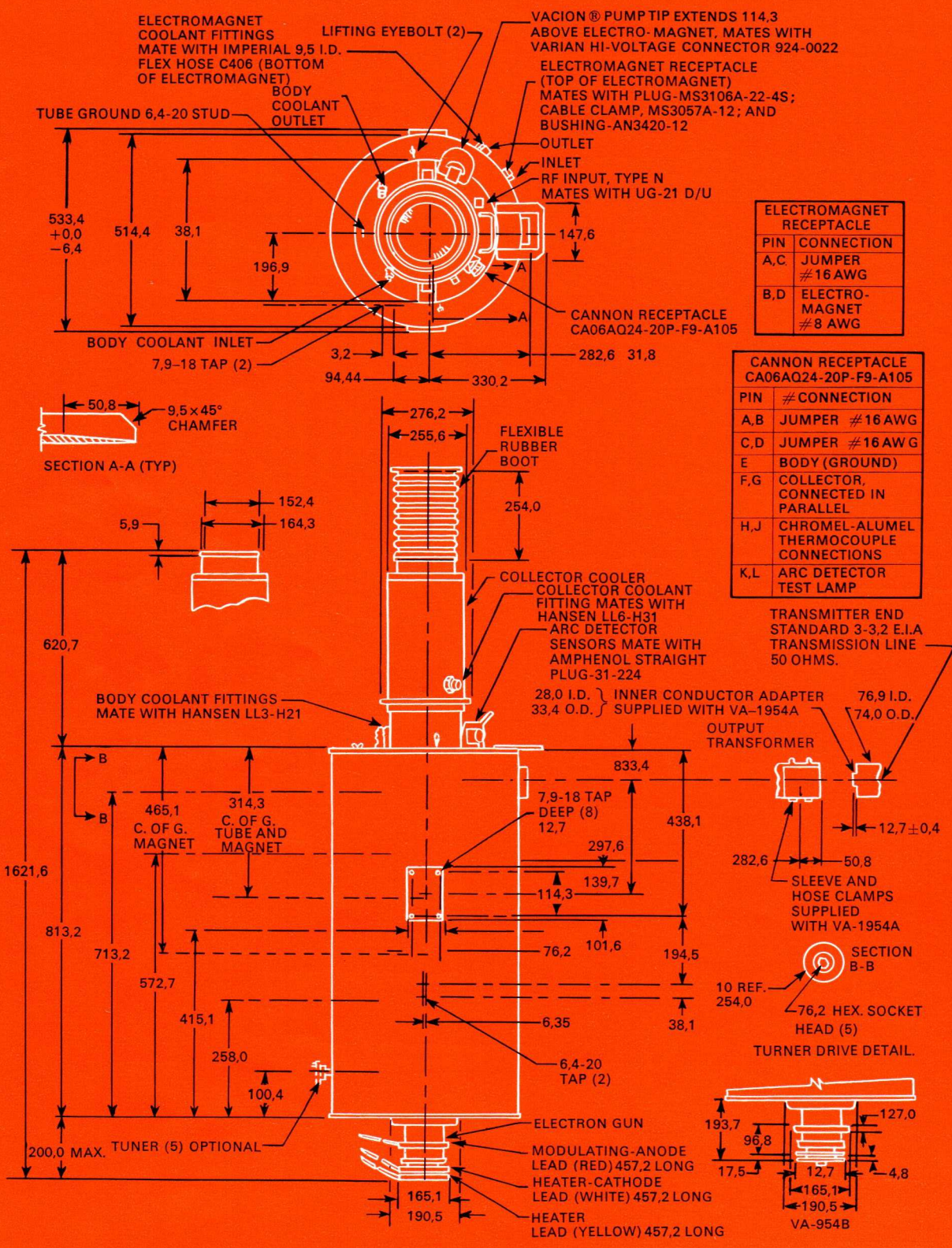
# outline drawing of VA-953A/B in VA-1953 A electromagnet



DIMENSIONS ARE IN MILLIMETRES

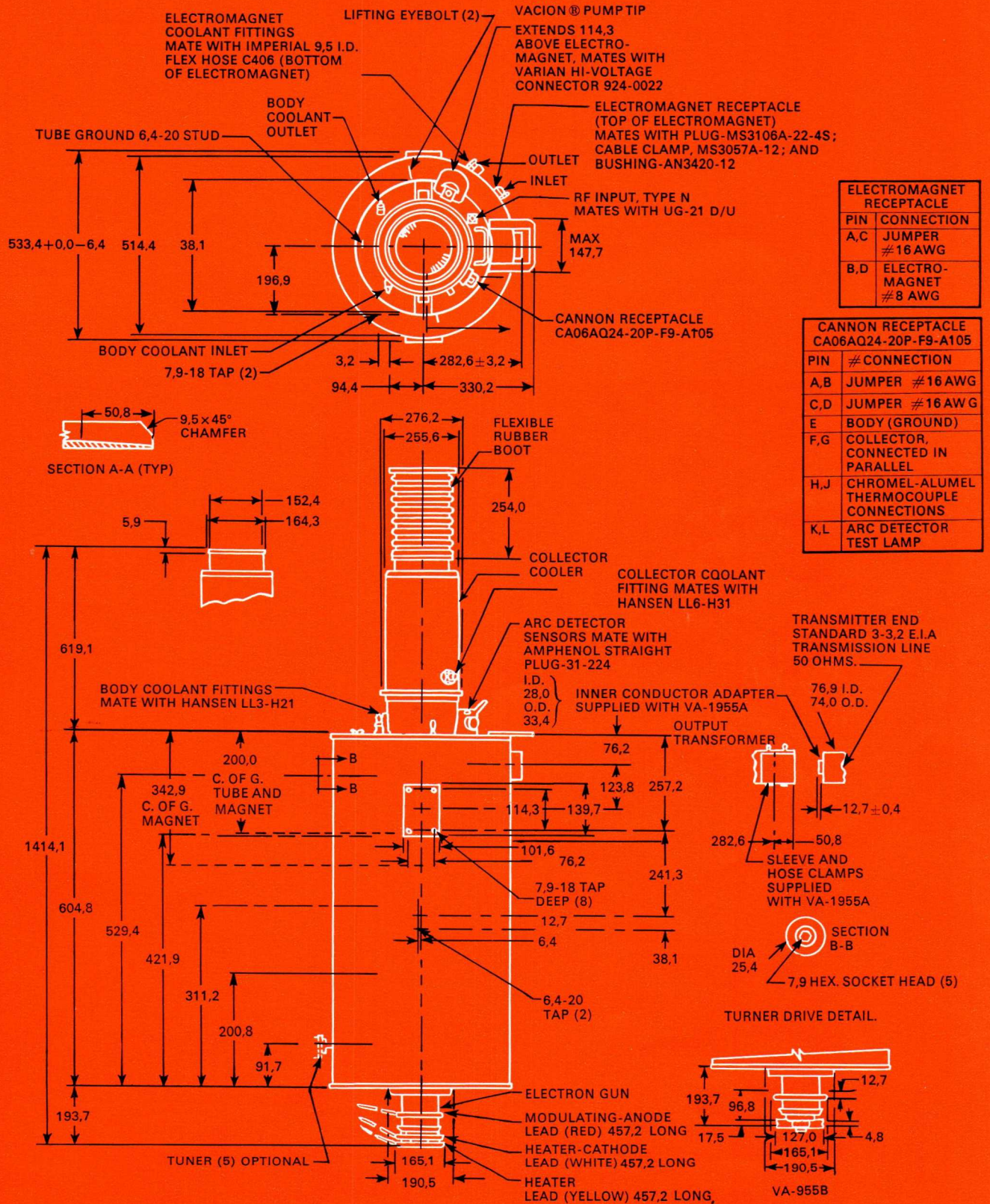


# outline drawing of VA-954A/B in VA-1954 A electromagnet





# outline drawing of VA-955A/B in VA-1955 A electromagnet





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

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**Ceramics in Electronics**  
**Microwave Products and Ceramic Components**  
**High-power Microwave Tubes**  
**Low Noise Travelling Wave Amplifiers**  
**Introduction to Dither Tuned Magnetrons**  
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**Introduction to Pulsed Crossed-Field Amplifiers**  
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