VARIAN
associates

1961 CATALOG

VARIAN ASSOCIATES
Palo Alto, California

BOMAC LABORATORIES, INC.
Beverly, Massachusetts

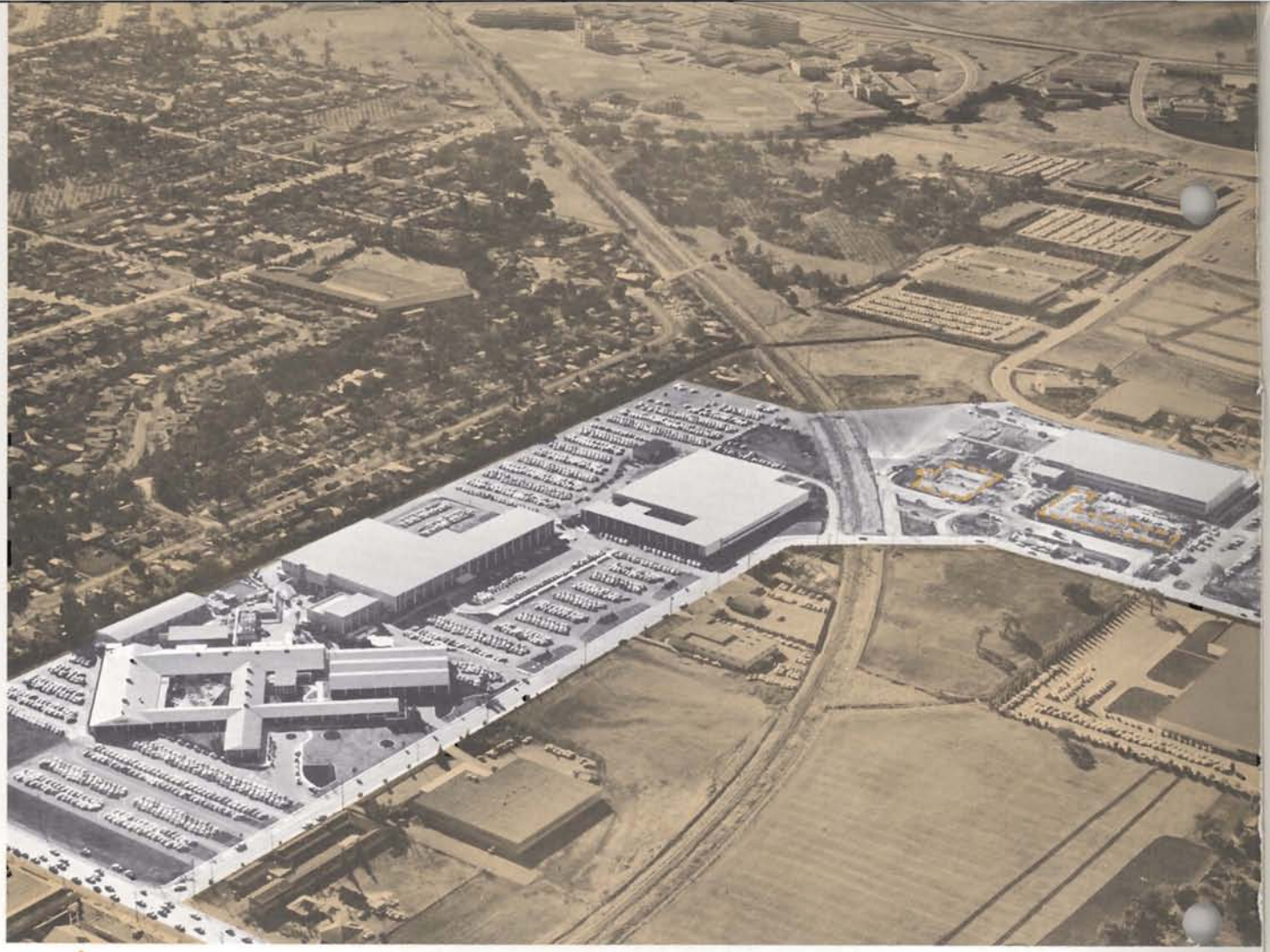
VARIAN ASSOCIATES OF CANADA, LTD.
Georgetown, Ontario, Canada

S-F-D LABORATORIES, INC.
Union, New Jersey

SEMICON ASSOCIATES, INC.
Lexington, Kentucky

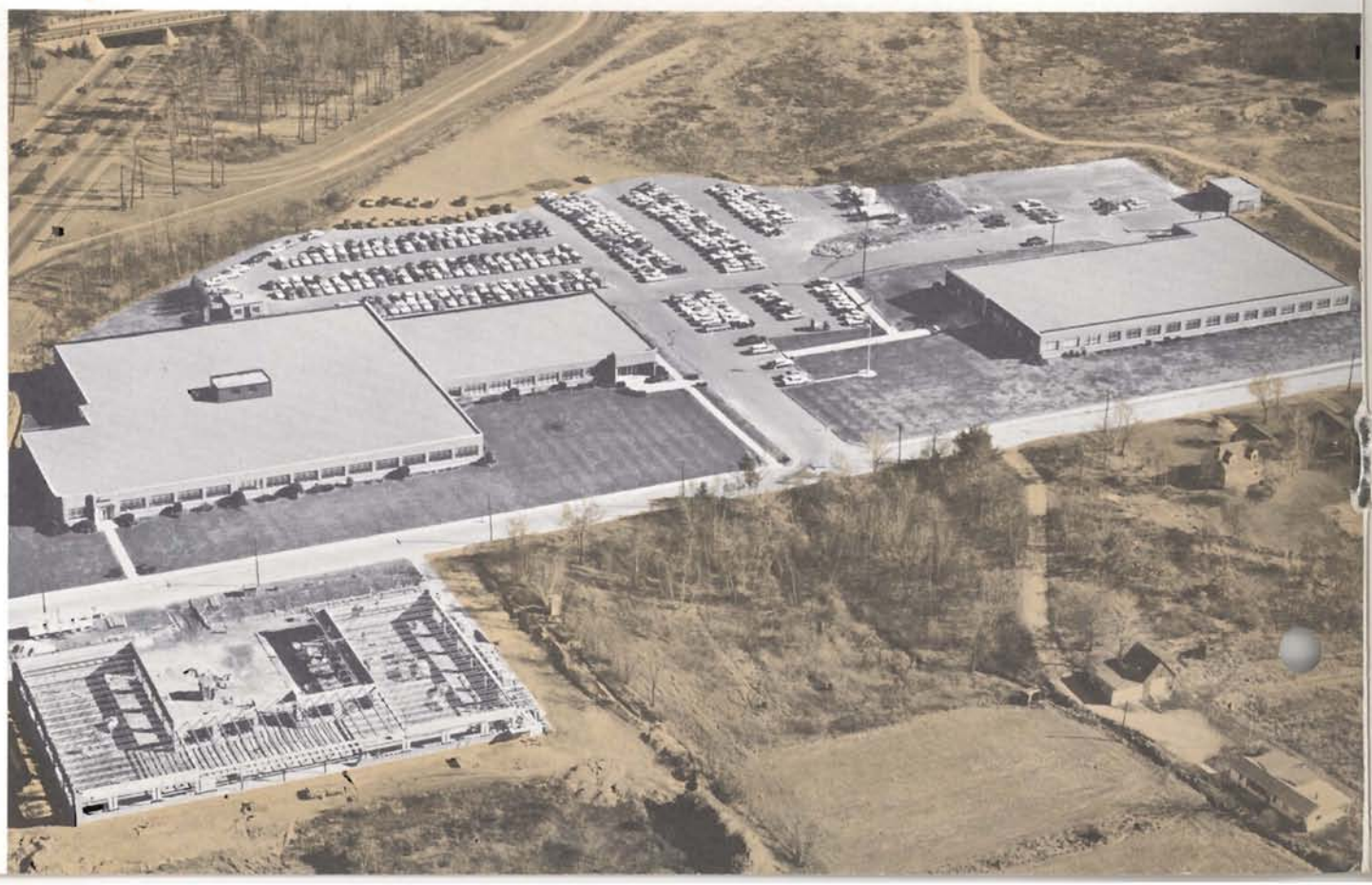
SEMICON OF CALIFORNIA, INC.
Watsonville, California

VARIAN A. G.
Zug, Switzerland



▲ Aerial View of Varian Associates, Palo Alto, California—Dotted Areas Indicate Administration Buildings Now Under Construction

▼ Aerial View of Bomac Laboratories, Inc., Beverly, Massachusetts—Showing Location and Construction of New Research Facilities



Varian Associates

In the twelve short years since its founding, Varian Associates has grown from a small research firm employing six persons to an international corporation with more than 3,500 employees. The company reported total sales in 1960 of more than $46,000,000 and has total assets of $43,000,000.

The original 1,200-square-foot building that housed Varian Associates in 1948 has been replaced by a complex of buildings totaling 840,000 square feet at the Palo Alto headquarters and subsidiary plants in California, Massachusetts, New Jersey, Kentucky, Canada and Switzerland.

Varian Associates produces a broad line of products, most of which represent significant advances in electronic technology. These products find applications in a wide number of fields, such as communications, both military and commercial; navigation and control of aircraft; advanced defense systems including early warning radars and missile guidance, detection, and ranging; research in the fields of chemistry, physics, biochemistry and medicine; magnetic detection for geophysical and scientific applications; control of industrial processes; and high vacuum pumping.

To maintain leadership in the microwave field, Varian Associates employs a staff of more than 400 outstanding engineers and research scientists working on new product development, product applications and basic research. This emphasis on research keeps Varian Associates pre-eminent in its chosen fields of effort.

Varian Subsidiaries . . .

BOMAC LABORATORIES, INC., BEVERLY, MASS.

VARIAN A.G., ZUG, SWITZERLAND

VARIAN ASSOCIATES OF CANADA, LTD.
GEORGETOWN, ONTARIO, CANADA

S-F-D LABORATORIES, INC., UNION, N.J.

SEMICON ASSOCIATES, INC.

BOMAC LABORATORIES, INC., Beverly, Mass.

In January 1959, Bomac Laboratories, world's largest producer of pulsed radar tubes, combined operations with Varian Associates in a move that has materially strengthened both companies. Production facilities are now available at two geographically separated plant sites; engineering talent and know-how has been pooled; and the two companies are now active in making all three of the major microwave tube types: klystrons, magnetrons and wave tubes. Bomac's product line has grown to include a broad group of microwave products including TR, ATR, and PreTR tubes, magnetrons, klystrons, wave tubes, silicon diodes and duplexers.

VARIAN ASSOCIATES OF CANADA, LTD., Georgetown, Ontario, Canada

Founded in 1954 as an engineering laboratory for development of small tubes for Canadian military requirements, Varian Associates of Canada has continuously broadened its operations. Activities have been expanded to include production of small klystrons for doppler navigators, missiles, fire control and microwave relay systems, high power klystrons for long-range communication systems and missile range instrumentation, TR tubes and graphic recorders.

S-F-D LABORATORIES, INC., Union, N. J.

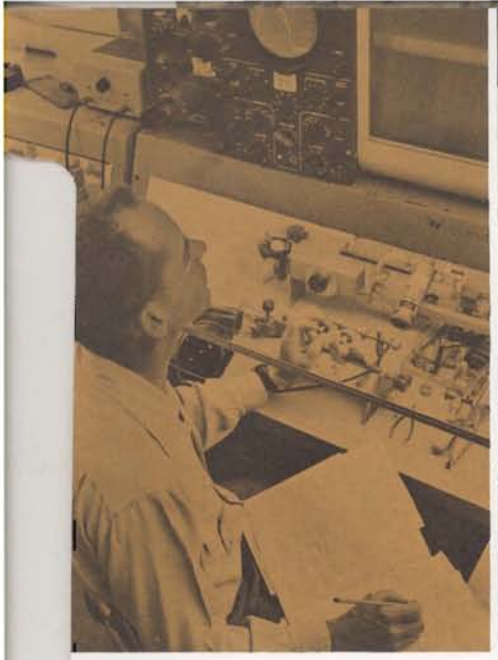
Broad diversification of product lines and entry into new fields in electronics were prime considerations in organizing S-F-D Laboratories, Inc., a basic research and development subsidiary located in Union, N.J. A trio of prominent scientists, each renowned in his own field, heads S-F-D Laboratories. Research activities at S-F-D center on development of new crossed field devices, including high power amplifiers and coaxial magnetrons, as well as parametric amplifiers and traveling wave tubes.

SEMICON ASSOCIATES, INC.

Negotiations were completed in June 1960 for Varian's acquisition of Semicon Associates, Inc., which consists of two companies, Semicon of Kentucky, Inc., located at Lexington, and Semicon of California, Inc., at Watsonville. The company is of special interest to Varian because of its strong position in the field of dispenser cathodes which are of increasing importance to microwave technology. Semicon is also one of the nation's outstanding fabricators of tungsten and other high temperature metals and ceramics and is active in research and development of components for thermionic generators of electricity.

VARIAN A.G., Zug, Switzerland

To facilitate Varian Associates' participation in expanding markets abroad, a new subsidiary has been formed in Switzerland. The new company, Varian A.G., has its main offices at Zug, with a research and applications laboratory at Zurich. In addition to performing the functions of marketing and technical servicing of Varian products in the European area, Varian A.G. will carry out significant research and development work providing important cross fertilization of ideas between American and foreign scientists and engineers.



REFLEX

REFLEX KLYSTRON OSCILLATORS

The primary applications for reflex klystrons are in receiver local oscillators, low power transmitters, signal generators and laboratory test equipment, generally requiring tubes of different designs. There are tubes listed in this catalog specifically designed for these varied applications.

The VA-244, VA-225, VA-220, VA-221 and VA-222 series are intended for Microwave Relay Systems operating in the 5.8 to 8.5 kMc bands either as the transmitter or local oscillator tubes. These tubes utilize the external tuning cavity design. Excellent frequency stability and long life are characteristic of this type of design, an obvious advantage in unattended fixed installations.

For many modern weapon systems extreme frequency stability is required under severe environmental conditions. Varian Associates has designed a series of rugged tubes ideally suited for missile, airborne radar and similar applications. Such tubes as the VA-201B, VA-210B, VA-217C, VA-94, VA-97 and VA-203B are typical modern highly reliable reflex oscillators. These tubes all utilize the integral external tuning cavity design. Such tubes are an order of magnitude better from the standpoint of vibration and shock than grid gap tuned tubes. These tubes are intended primarily as local oscillators.

Reflex klystrons have found another important use as the pump tube for parametric amplifiers. Reflex klystrons such as the VA-239 and VA-240 provide the required amounts of pump power for parametric amplifiers requiring pump frequencies as high as 35 kMc.

In many systems a driver tube is required for use with a multi-cavity amplifier. For ease of adjustment, it is simpler to trim the reflex driver tube to the exact frequency of the amplifier rather than trim the amplifier to a fixed drive frequency. For such semi-fixed frequency low power applications a new class of tube, designated as "trimmable fixed frequency," has been designed. Such tubes as the VA-242, VA-246 and VA-249 are exceptionally rugged and ideally suited to missile, airborne radar and doppler navigation applications. Primarily for fixed frequency operations, they can be trimmed ±50 Mc about their nominal center frequency.

The X-13, X-26, V-55 and V-58 are reflex oscillators that will deliver several hundred milliwatts of rf power. These tubes utilize grid gap tuning and are intended primarily for low power transmitters in microwave relay or similar applications and for laboratory use.

CUSTOM TUBES

Varian Associates manufactures many special tubes designed for a particular application. These "custom" tubes are not listed in this catalog. In addition, there are many tubes now in production which are classified for security reasons. Information on classified tubes can be made available to qualified customers upon receipt of proper authorization. In the event you do not find a suitable tube listed in this catalog, we suggest that you contact us since a suitable tube may be in existence. If a suitable tube does not exist, Varian Associates is prepared to modify an existing tube or develop a new tube for your specific application.

KLYSTRONS

ARRANGED BY FREQUENCY BANDS

C-BAND OSCILLATOR

VA-220J
4.9 to 5.2 kMc

- *For Transmitter Service*
- *Exceptional Frequency Stability*

Same as VA-220B-G, but uses rectangular CMR-187 flange. VA-1121 adapter available to convert to round UG-149A/U flange.

CHARACTERISTICS:

Frequency	4.9 Min.	4.9 Avg.	5.2 Min.	5.2 Avg.	kMc
Power Output	600	720	600	1000	mW
Beam Voltage	—	750	—	750	Vdc
Beam Current	—	70	—	71	mAdc
Reflector Voltage	−250	−305	—	−370	Vdc
Bandwidth	21	36	21	33	Mc

C-BAND OSCILLATOR

VA-221H
5.25 to 5.56 kMc

- *Exceptional Frequency Stability*
- *Negligible Microphonics*
- *Single Shaft Tuner*
- *Small Flange for Miniaturized Equipment*
- *Precisely Controlled Reflector Voltage*
- *Negligible Altitude Coefficient*

This reflex klystron oscillator is unsurpassed for local oscillator use in Weather Radar Systems. Satisfactory operation can be obtained at a resonator voltage as low as 250 volts. The VA-221H will start oscillating at —50°C as readily as at room temperature and will withstand vibration up to 40 G. RF output mates with rectangular CMR-159 flange.

CHARACTERISTICS:

Frequency	5.25 Min.	5.25 Avg.	5.56 Min.	5.56 Avg.	kMc
Power Output	20	40	20	48	mW
Beam Voltage	—	250	—	250	Vdc
Beam Current	—	19	—	20	mAdc
Reflector Voltage	−130	—	—	−155	Vdc
Bandwidth	25	33	25	35	Mc

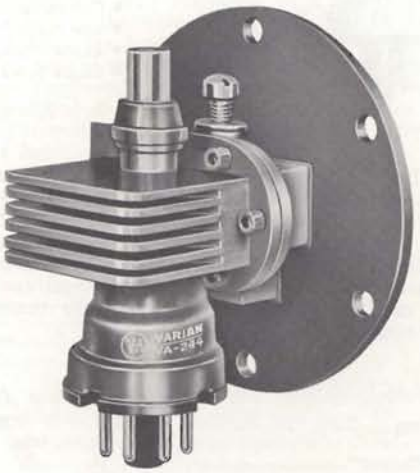
C-BAND OSCILLATORS

New

VA-244A
5.8 to 6.6 kMc

VA-244B
6.5 to 7.3 kMc

VA-244C
7.1 to 7.9 kMc



- *Wide Tuning Range*
- *Easily Tuned*
- *Reliable*

The VA-244 reflex klystrons are conduction cooled, long life, stable, low distortion tubes for microwave relay applications. Each tube type provides a wide tuning range together with an average power output of 1 watt for transmitters. As local oscillators, these tubes operate at reduced voltages with an average power output of 50 milliwatts. The VA-244 tubes are ideal for use in new equipments in the common carrier band.

CHARACTERISTICS, VA-244B:

Frequency	6.5 Min.	6.5 Avg.	7.3 Min.	7.3 Avg.	kMc
Power Output	700	1000	700	1100	mW
Beam Voltage	—	750	—	750	Vdc
Beam Current	—	78	—	78	mAdc
Reflector Voltage	−275	−290	—	−440	Vdc
Bandwidth	30	40	30	50	Mc
Power Output	25	50	25	50	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	20	—	20	mAdc
Reflector Voltage	−100	−125	—	−190	Vdc
Bandwidth	25	30	25	30	Mc

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

REFLEX

C-BAND OSCILLATOR

VA-221A-G, K
5.860 to 7.850 kMc

VA-220A-G, Z
5.925 to 8.100 kMc

- *Excellent Reliability*
- *Long Life*
- *Controlled Characteristics*
- *Low Noise*
- *Rapid Warmup*
- *Single Screw Tuner*

The VA-220 and VA-221 series of reflex klystrons were developed primarily for local oscillator or low power transmitter operation in microwave relay systems. The VA-220 series provides approximately 1 watt of power for transmitters. The VA-221 series provides approximately 30 milliwatts for local oscillator application. The integral external cavity design insures excellent stability and is accurately tuned by a single screw tuner.

CHARACTERISTICS, VA-221C*:

	6.955		7.255		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output**	25	36	25	39	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	23	—	22	mAdc
Reflector Voltage	—75	—96	—	—111	Vdc
Bandwidth	25	33	25	39	Mc

*Similar characteristics for other tubes in the VA-221 series.

**VA-221A has a minimum power output of 20 mW.

CHARACTERISTICS, VA-220C:

	6.875		7.125		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output	700	950	700	1050	mW
Beam Voltage	—	750	—	750	Vdc
Beam Current	—	72	—	71	mAdc
Reflector Voltage	—250	—325	—250	—370	Vdc
Bandwidth	28	40	28	40	Mc

The minimum characteristics are the same for all tubes in the VA-220B to VA-220G group.

The minimum characteristics for the VA-220A are the same except bandwidth minimum is 25 Mc.

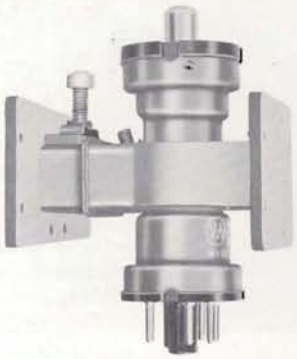
The minimum characteristics for the VA-220Z are the same except bandwidth minimum is 21 Mc and power output minimum is 500 mW.

MECHANICAL TUNING RANGE:

VA-221K	5.860 - 6.160	kMc	VA-220F	5.925 - 6.225	kMc
VA-221F	5.985 - 6.285	kMc	VA-220E	6.125 - 6.425	kMc
VA-221G	6.505 - 6.705	kMc	VA-220G	6.425 - 6.575	kMc
VA-221E	6.285 - 6.585	kMc	VA-220D	6.575 - 6.875	kMc
VA-221D	6.705 - 7.005	kMc	VA-220C	6.875 - 7.125	kMc
VA-221C	6.955 - 7.255	kMc	VA-220B	7.125 - 7.425	kMc
VA-221B	7.255 - 7.555	kMc	VA-220A	7.425 - 7.750	kMc
VA-221A	7.550 - 7.850	kMc	VA-220Z	7.750 - 8.100	kMc

The VA-220 klystrons are recommended replacements for the X-26 klystrons. In equipment where the effective resonator position is important, the VA-1120 adapter should be used.

C-BAND OSCILLATOR



VA-222A-G, Z
5.925 to 8.100 kMc

- *For Microwave Relay Transmitters*
- *Conduction Cooled*

Identical electrically to the VA-220 A-G, and Z series of klystrons. Miniature rectangular output flange mates with CMR-137 flange. Conduction cooling eliminates need for blower.

H-BAND OSCILLATOR

VA-225A
7.5 to 8.5 kMc

VA-225B
7.0 to 8.0 kMc

VA-225C
7.0 to 8.0 kMc

- *Conduction Cooled*

The VA-225 klystrons are designed for use in line-of-sight relay communication systems in the Government band (7.125 to 8.500 kMc). Depending on resonator voltage used, these versatile tubes will provide either 1 watt or 100 milliwatts output in transmitters, or 30 milliwatts for local oscillator receiver service. Conduction cooling eliminates the need for a blower. The VA-225A and VA-225B mate with the UG-51/U flange. The VA-225C mates with the CMR-137 flange.

CHARACTERISTICS, VA-225A:

	7.5		8.5		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output	700	1450	700	1000	mW
Beam Voltage	—	750	—	750	Vdc
Beam Current	—	74	—	73	mAdc
Reflector Voltage	—250	—265	—250	—400	Vdc
Bandwidth	25	63	25	37	Mc
Power Output	100	375	100	285	mW
Beam Voltage	—	500	—	500	Vdc
Beam Current	—	40	—	39	mAdc
Reflector Voltage	—125	—150	—125	—245	Vdc
Bandwidth	25	55	25	35	Mc
Power Output	20	45	20	40	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	19	—	18	mAdc
Reflector Voltage	—50	—60	—50	—105	Vdc
Bandwidth	20	46	20	28	Mc

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

X-BAND OSCILLATOR

X-13
8.1 to 12.4 kMc

X-13B
7.5 to 11.0 kMc

- *Wide Frequency Range*
- *High Power Output*

These micrometer tuned reflex klystron oscillators have high power output over a wide frequency range and are particularly designed for use as bench oscillators. They are also ideal for signal generator and antenna measurement use.

CHARACTERISTICS, X-13:

	8.1		12.4		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output, optimum	100	180	100	230	mW
Beam Voltage	—	500	—	500	Vdc
Beam Current	30	55	30	54	mAdc
Reflector Voltage	—	—285	—	—350	Vdc
Bandwidth	—	60	—	45	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

X-BAND OSCILLATOR

VA-201B
8.5 to 9.6 kMc

- *Extra Rugged Construction*
- *Negligible Microphonics, Low Temperature Coefficient*
- *Adaptable to Motor Tuning*
- *Fast Warmup*

The VA-201B is a rugged, reflex klystron for local oscillator service in beacon and airborne radar applications. The tube has excellent frequency stability and low noise characteristics under severe shock, vibration and temperature cycling conditions, making high altitude operation very reliable.

CHARACTERISTICS:

	8.5		9.6		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output	40	46	40	60	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	38	—	38	mAdc
Reflector Voltage	—80	—105	—130	—160	Vdc
Bandwidth	20	40	20	46	Mc

X-BAND OSCILLATOR

VA-203B/6975
8.5 to 9.6 kMc

- *Reliable Performance*
- *Very Stable*
- *Controlled Reflector Voltage*
- *Single Screw Tuning*
- *Low Cost*

Frequency stability and reliability in airborne environments are the key to the widespread acceptance of the VA-203B. The VA-203B has long life and features excellent stability with variations in resonator and heater voltages. Spurious oscillations are suppressed well below interference levels and the reflector voltage mode is free from discontinuities. Close manufacturing tolerances in the VA-203B result in narrow reflector voltage limits simplifying AFC design.

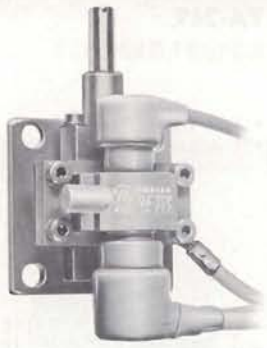
CHARACTERISTICS:

	8.5		9.6		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output	20	30	20	32	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	29	—	30	mAdc
Reflector Voltage	—85	—95	—140	—145	Vdc
Bandwidth	30	39	30	43	Mc

VA-1011A and VA-1011B, molded silicone rubber connectors, are available for the VA-203B, see page 57.

This tube is also manufactured by Varian Associates of Canada, Ltd.

X-BAND OSCILLATOR



VA-217C
8.5 to 9.6 kMc

- *Low Voltage Operation*
- *Most Rugged Tunable X-Band Oscillator Available*
- *Excellent Frequency Stability*
- *Very Low Noise*
- *Long Life Tuner*
- *All Ceramic Seals*
- *Conduction Cooled*

The tube was designed specifically for missile use, and will perform under the most severe environments. The excellent frequency stability and very low noise under extreme environmental conditions make this tube well suited for beacon and all types of airborne applications. The long life tuner is ideally suited for servo-drive use.

CHARACTERISTICS:

	8.5		9.6		kMc
Frequency	Min.	Avg.	Min.	Avg.	
Power Output	20	30	20	35	mW
Beam Voltage	—	250	—	250	Vdc
Beam Current	—	21	—	21	mAdc
Reflector Voltage	—45	—50	—80	—85	Vdc
Bandwidth	40	49	40	50	Mc

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

PAGE 16 TO 19
PAGE 20 TO 25
PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

X-BAND OSCILLATOR

New

VA-242 Series
8.5 to 11.0 kMc

- *Extremely Rugged*
- *Trimmable ±50 Mc*

The VA-242 is an extremely rugged reflex klystron. Although basically a fixed-tuned tube, it can be readily trimmed to any exact required frequency within the ±50 Mc trimmable tuning range provided. It is especially recommended for airborne applications under severe conditions of vibration and humidity and is an excellent choice for STALO and parametric pump applications. Tubes are available at any required frequency between 8.5 and 11.0 kMc.

CHARACTERISTICS:

	Min.	Avg.	
Power Output	500	725	mW
Beam Voltage	—	500	Vdc
Beam Current	45	55	mAdc
Reflector Voltage	−270	−315	Vdc

This tube is also manufactured by Varian Associates of Canada, Ltd.

X-BAND OSCILLATOR

VA-232
9.2 to 10.0 kMc

This reflex klystron was built specifically for an exceptionally high degree of stability under severe environmental conditions. The tube features unexcelled temperature, warm-up, and vibrational stability with less than 200 kc frequency deviation at 30 G's of vibration. The new Varian long life tuner —10,000 cycles minimum—makes this tube ideal for servo-tuned systems as well as all missile and airborne applications.

CHARACTERISTICS:

Frequency	9.2		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	155	225	155	225	mW
Beam Voltage	—	350	—	350	Vdc
Beam Current	—	39	—	39	mAdc
Reflector Voltage	−200	−220	—	−280	Vdc
Bandwidth	30	37	30	35	Mc

X-BAND OSCILLATOR

New

VA-249
8.5 to 11.0 kMc

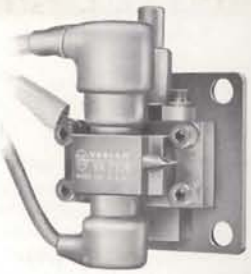
- *Long Life*
- *Trimmable ±50 Mc*

The VA-249 is a rugged, long-life, trimmable reflex klystron. Although basically a fixed-tuned tube, it can be readily trimmed to any exact required frequency within the ±50 Mc trimmable tuning range provided. The VA-249 is especially well suited for applications where long unattended service and excellent reliability are important, such as railroad and police doppler radar systems. Tubes are available at any required frequency between 8.5 and 11.0 kMc.

CHARACTERISTICS:

	Min.	Avg.	
Power Output	70	80	mW
Beam Voltage	—	300	Vdc
Beam Current	—	30	mAdc
Reflector Voltage	−300	−320	Vdc

X-BAND OSCILLATOR



VA-210B
9.6 to 10.8 kMc

- *Most Rugged Tunable X-Band Oscillator Available*
- *Excellent Frequency Stability*
- *Very Low Noise*
- *Long Life Tuner*
- *All Ceramic Seals*

This tube was designed specifically for missile use and will perform under the most severe environments. The excellent frequency stability and very low noise under extreme environmental conditions make this tube well suited for beacon and all types of airborne applications. The long life tuner is ideally suited for servo-drive.

CHARACTERISTICS:

Frequency	9.6		10.8		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	30	32	30	60	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	28	—	27	mAdc
Reflector Voltage	−70	−85	−120	−127	Vdc
Bandwidth	20	39	20	43	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

KLYSTRONS

ARRANGED BY FREQUENCY BANDS

X-BAND OSCILLATORS

VA-218B
10.525 kMc

- *Long Life*
- *Excellent Reliability*
- *Rugged Construction*
- *Simple to Install*
- *Waveguide Output*

The VA-218B is a fixed frequency reflex klystron designed to operate in the increasingly important public service radio location band. This tube features the latest advancements in klystron techniques. The VA-218B is suitable for applications where long unattended service and excellent reliability are of importance, such as railroad and police doppler radar systems.

CHARACTERISTICS:

	10.525 ±0.012		kMc
	Min.	Avg.	
Power Output	25	55	mW
Beam Voltage	—	300	Vdc
Beam Current	—	31	mAdc
Reflector Voltage	−150	−240	Vdc

X-BAND OSCILLATOR

New

VA-204
10.525 kMc

- *Long Life*
- *Low Power Consumption*
- *Waveguide Output*
- *Reliability*
- *Single Plug Power Connector*

The VA-204 is a fixed frequency reflex klystron designed for operation in the public service radio location band. The tube has been especially designed for applications where long unattended service and a high degree of reliability are of importance, such as railroad and traffic control radar systems. Unique construction allows for a single plug power connection and aids greatly in simplified equipment design.

CHARACTERISTICS:

	10.525 ±0.010		kMc
	Min.	Avg.	
Power Output	20	40	mW
Beam Voltage	—	300	Vdc
Beam Current	—	28	mAdc
Reflector Voltage	−40	−50	Vdc

Ku-BAND OSCILLATORS

V-39B	10.0 to 15.5 kMc
V-40B	15.0 to 21.0 kMc

Wide tuning range reflex klystron oscillators for signal generators and wide range receivers. These rugged reflex klystrons with suitable external tuning cavities VA-1239A and VA-1240A, respectively for the V-39B and V-40B, provide exceptionally wide tuning range, high power output and low tuning rate combined with accurate resetability.

CHARACTERISTICS, V-39B in VA-1239A Cavity:

		10.0	13.5	15.5	kMc
	Min.	Avg.	Avg.	Avg.	
Power Output	10	55	140	75	mW
Beam Voltage	—	650	650	650	Vdc
Beam Current	16	30	30	30	mAdc
Reflector Voltage	−100	−155	−200	−320	Vdc

CHARACTERISTICS, V-40B in VA-1240A Cavity:

		15.0	18.5	21.0	kMc
	Min.	Avg.	Avg.	Avg.	
Power Output	10	40	75	85	mW
Beam Voltage	—	750	750	750	Vdc
Beam Current	16	30	30	30	mAdc
Reflector Voltage	−100	−225	−450	−315	Vdc

VA-1239A Cavity	**VA-1240A** Cavity
Use with V-39B klystron	Use with V-40B klystron

Fixed mode suppressors are included in the cavities.

Ku-BAND OSCILLATOR

X-12
12.4 to 18.0 kMc

- *Wide Frequency Range*
- *Long Life*

A micrometer tuned Ku-band reflex klystron oscillator for bench oscillator and signal generator use. Waveguide output mates with UG-419/U cover flange. Has low current heater for long tube life.

CHARACTERISTICS:

	12.4		15.2		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	25	155	25	120	mW
Beam Voltage	—	600	—	600	Vdc
Beam Current	—	58	—	55	mAdc
Reflector Voltage	—	−245	—	−280	Vdc
Heater Current	—	0.45	—	0.45	A

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REFLEX

Ku-BAND OSCILLATOR

VA-92B

12.4 to 14.5 kMc

- *Good Frequency Stability*
- *Slow Tuning Rate*
- *Low Microphonics*

The VA-92B is a rugged Ku-band reflex klystron. Incorporating a single screw tuner, with a low tuning rate, the VA-92B is an excellent choice for Ku-band microwave relay transmitter or local oscillator service. The molded leads permit high altitude operation without pressurization.

CHARACTERISTICS:

Frequency	12.4 Min.	12.4 Avg.	14.5 Min.	14.5 Avg.	kMc
Power Output	140	220	140	545	mW
Beam Voltage	—	600	—	600	Vdc
Beam Current	—	59	—	58	mAdc
Reflector Voltage	—	200	—	400	Vdc
Bandwidth	50	55	50	60	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

Ku-BAND OSCILLATOR

VA-92C

12.4 to 14.5 kMc

- *Good Frequency Stability*
- *Slow Tuning Rate*
- *Low Microphonics*

The VA-92C is an easily tuned reflex klystron designed to accommodate the application requirements of the 12.4 to 14.5 kMc frequency range. As well as an excellent oscillator for radar and test equipment use, the ion-free electron optics of the VA-92C afford excellent performance for microwave relay service.

CHARACTERISTICS:

Frequency	12.4 Min.	12.4 Avg.	14.5 Min.	14.5 Avg.	kMc
Power Output	140	190	140	400	mW
Beam Voltage	—	600	—	600	Vdc
Beam Current	—	60	—	56	mAdc
Reflector Voltage	—	220	—	240	Vdc
Bandwidth	50	55	50	60	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

Ku-BAND OSCILLATOR

VA-92 | 14.0 to 17.5 kMc

The VA-92 is a rugged Ku-band reflex klystron designed for 600 volt operation. It incorporates a single screw tuner with a low tuning rate. Suitable for airborne local oscillator service.

Electrical characteristics are similar to the X-12 over the range covered by the VA-92.

Ku-BAND OSCILLATOR

New **VA-246** | 11.0 to 14.0 kMc

- *M-Band Flange*
- *Trimmable ± 50 Mc*

The VA-246 is an extremely rugged, fixed tuned, trimmable reflex klystron oscillator. Although basically a fixed tuned tube, it can be readily trimmed to any exact required frequency within the ±50 Mc trimmable tuning range provided. It is similar to the VA-242 but operates at higher frequencies. The VA-246 RF output flange mates with the WR-75 M-Band flange. Tubes are available at any required frequency between 11 and 14 kMc.

CHARACTERISTICS:

	Min.	Avg.	
Power Output	500	680	mW
Beam Voltage	—	500	Vdc
Beam Current	45	55	mAdc
Reflector Voltage	−250	−320	Vdc

This tube is also manufactured by Varian Associates of Canada, Ltd.

Ku-BAND OSCILLATOR

New **VA-240** | 17.0 to 19.0 kMc

- *Stable*
- *Reliable*

The VA-240 is a rugged, fixed tuned reflex klystron ideally suited for use in airborne applications and as a pump tube in parametric amplifiers. It is lightweight, compact and air cooled. The VA-240 is available preset at any specified frequency between 17.0 and 19.0 kMc and can be trimmed ±50 Mc by the user.

CHARACTERISTICS:

Frequency	18.0 Min.	18.0 Avg.	kMc
Power Output	200	275	mW
Beam Voltage	—	750	Vdc
Beam Current	—	32	mAdc
Reflector Voltage	−200	−270	Vdc
Bandwidth	40	70	Mc

Ku-BAND OSCILLATORS

VA-94

16.0 to 17.0 kMc

VA-94B

15.8 to 16.2 kMc

These compact reflex klystron oscillators offer excellent frequency stability as a result of the unique integral external tuning cavity. Ideally suited as local oscillators for airborne receivers or in other systems operating in a severe environment. The long life, low tuning rate, low torque tuners make these tubes adaptable for motor tuned systems. Molded base and leads permit high altitude operation without pressurization. Special versions are available for plunger tuner applications.

CHARACTERISTICS:

Frequency	VA-94 16.5 Min.	VA-94 16.5 Avg.	VA-94B 16.0 Min.	VA-94B 16.0 Avg.	kMc
Power Output	20	40	20	35	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	25	38	25	38	mAdc
Reflector Voltage	−100	−150	−95	−110	Vdc
Bandwidth	55	70	50	60	Mc

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KLYSTRONS

ADDITIONAL REFLEX KLYSTRONS ARE LISTED ON PAGES 12, 13, 14 AND 15

K-BAND OSCILLATOR

VA-96

22.0 to 25.0 kMc

- *Wide Tuning Range*
- *Reliable Performance*

A rugged lock nut tuned K-band reflex klystron oscillator intended for fixed frequency operation. Provides typically 40 mW matched power output at a resonator voltage of 750 volts.

CHARACTERISTICS:

Frequency	22.0 Min.	22.0 Avg.	25.0 Min.	25.0 Avg.	kMc
Power Output	20	35	20	35	mW
Beam Voltage	—	750	—	750	Vdc
Beam Current	—	32	—	32	mAdc
Reflector Voltage	−125	−140	—	−180	Vdc
Bandwidth	50	120	50	120	Mc

K-BAND OSCILLATOR

VA-98E

23.6 to 24.4 kMc

A compact, low voltage reflex klystron oscillator of the external cavity design. The VA-98E is extremely stable and rugged, as well as easily tuned, affording unmatched local oscillator performance.

CHARACTERISTICS:

Frequency	24.0 Min.	24.0 Avg.	kMc
Power Output	12	30	mW
Beam Voltage	—	375	Vdc
Beam Current	18	32	mAdc
Reflector Voltage	−120	−152	Vdc
Bandwidth	65	80	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

K-BAND OSCILLATORS

VA-97

34.0 to 35.6 kMc

VA-97B

32.6 to 34.0 kMc

- *Excellent Frequency Stability*
- *Small Size, Light Weight*
- *Single Screw Tuning*

This small, very rugged reflex klystron is ideally suited for airborne radar or other systems requiring good frequency stability in a severe environment. Low voltage operation (400 volts) simplifies power supply design. Special versions are available for plunger tuner applications.

CHARACTERISTICS, VA-97:

Frequency	34.0 Min.	34.0 Avg.	35.6 Min.	35.6 Avg.	kMc
Power Output	10	16	10	25	mW
Beam Voltage	—	400	—	400	Vdc
Beam Current	30	35	30	35	mAdc
Reflector Voltage	−75	−145	—	−170	Vdc
Bandwidth	60	85	60	90	Mc

K-BAND OSCILLATOR

New

VA-239

34.0 to 35.6 kMc

- *High Power*
- *Frequency "Settability"*

The VA-239 is a rugged, frequency settable reflex klystron designed for applications requiring medium output power at 35 kMc for either ground based or airborne equipments. The operating characteristics of the VA-239 make it especially well suited for parametric pump applications. The very compact and light weight design results from its use of electrostatic focusing and air cooling. The VA-239 is available preset at any specified frequency between 34.0 to 35.6 kMc and can be trimmed ±50 Mc by the user.

CHARACTERISTICS:

Frequency	35.0 Min.	35.0 Avg.	kMc
Power Output	250	400	mW
Beam Voltage	—	2500	Vdc
Beam Current	—	25	mAdc
Reflector Voltage	−250	—	Vdc
Bandwidth	50	—	Mc

REFLEX KLYSTRON OSCILLATOR

New

VA-250

68.0 to 74.0 kMc

- *Reliable Performance*
- *Designed for Rugged Environment*
- *Easily Tuned*
- *Small Size*

The VA-250 is a compact reflex klystron oscillator featuring easy single screw tuning in an integral cavity structure. Designed as a rugged tube for operation in a severe environment, the tube has a molded base and leads permitting high altitude operation without pressurization.

CHARACTERISTICS:

Frequency	72 Min.	72 Avg.	kMc
Power Output	10	20	mW
Beam Voltage	—	2500	Vdc
Beam Current	11	14	mAdc
Reflector Voltage	—	−300	Vdc
Bandwidth	—	100	Mc

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PAGE 16 TO 19
PAGE 20 TO 25
PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

BOMAC X-BAND KLYSTRON

BL-829

8.0 to 9.5 kMc

- *Low Noise and Microphonics*
- *Compact Ceramic Metal Construction*

The BL-829 is a ceramic and metal, long life, fixed frequency reflex klystron for use as a transmitting tube in navigational doppler radar. It maintains excellent stability under severe environmental conditions. The temperature coefficient for this tube is only 40 kc/°C. Frequency trimming is provided by a window flange screw. Copper cooling fins produce efficient cooling at maximum ratings.

CHARACTERISTICS:

*Frequency	8.0		9.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	400	500	400	500	mW
Beam Voltage	—	500	—	500	Vdc
Beam Current	—	55	—	55	mAdc
Reflector Voltage	—	−290	—	−300	Vdc
Bandwidth	45	50	45	50	Mc

***Frequency can be factory preset at any specified frequency between 8.0 to 9.0 kMc.**

BOMAC X-BAND KLYSTRON

BL-806

8.5 to 10.0 kMc

A medium power reflex klystron for use in low power transmitters, or as a reliable local oscillator. Top cap and base permit simple, rapid installation or replacement. Differential screw tuning provides a slow tuning rate allowing precise adjustment of frequency.

CHARACTERISTICS:

Frequency	8.5		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	200	350	200	250	mW
Beam Voltage	—	500	—	500	Vdc
Beam Current	—	50	—	50	mAdc
Reflector Voltage	—	−330	—	−440	Vdc
Bandwidth	30	45	30	40	Mc

BOMAC X-BAND KLYSTRON

6310

8.5 to 10.0 kMc

- *Rugged*
- *Simple Installation*

A rugged, single screw tuned reflex klystron for local oscillator and signal generator applications. Top cap and base permit simple installation and replacement. Electrically similar to the 6312.

CHARACTERISTICS:

Frequency	8.5		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	25	70	25	60	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	20	26	20	26	mAdc
Reflector Voltage	−85	−110	−160	−190	Vdc
Bandwidth	30	40	30	40	Mc

BOMAC X-BAND KLYSTRONS

BL-800/6780

8.5 to 10.0 kMc

BL-800A/6316*

8.5 to 10.0 kMc

- *Lock Nut Tuning*

A rugged reflex klystron with lock nut tuning, designed primarily for fixed frequency operation at low resonator voltages. Leads molded in silicone rubber permit operation at all altitudes and in high humidity.

CHARACTERISTICS:

Frequency	8.5		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	15	25	15	20	mW
Beam Voltage	—	200	—	200	Vdc
Beam Current	—	20	—	20	mAdc
Reflector Voltage	—	−50	—	−145	Vdc
Bandwidth	20	30	20	30	Mc

***BL-800A/6316 operates into a 1.5 VSWR mismatch.**

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KLYSTRONS

ADDITIONAL REFLEX KLYSTRONS ARE LISTED ON PAGES 14 AND 15

BOMAC X-BAND KLYSTRON

6312

8.5 to 10.0 kMc

- *Single Screw Tuning*

A single screw tuned reflex klystron for use in local oscillator and signal generator applications. Leads molded in silicone rubber permit operation at all altitudes and in high humidity. Electrically similar to 6310.

CHARACTERISTICS:

Frequency	8.5		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	25	70	25	60	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	20	26	20	26	mAdc
Reflector Voltage	−85	−110	−160	−190	Vdc
Bandwidth	30	40	30	40	Mc

BOMAC X-BAND KLYSTRON

BL-803/6781

8.5 to 10.0 kMc

The BL-803/6781 is a rugged, tunable integral cavity, reflex klystron for local oscillator use at low resonator voltages. The coupling design permits operation into a 1.5 VSWR mismatch with little drop in power or pulling of frequency. A differential screw tuning arrangement permits precise frequency adjustments.

CHARACTERISTICS:

Frequency	8.5		10.0		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	15	25	15	20	mW
Beam Voltage	—	200	—	200	Vdc
Beam Current	—	20	—	20	mAdc
Reflector Voltage	—	−50	—	−145	Vdc
Bandwidth	20	30	20	30	Mc

BOMAC X-BAND KLYSTRON

BL-807

8.5 to 10.5 kMc

The BL-807 is a rugged, tunable integral cavity, reflex klystron for local oscillator or low power fixed frequency transmitter applications. It produces an average matched power output of 125 mW with only 350 volts resonator voltage.

CHARACTERISTICS:

Frequency	8.5		10.5		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	50	100	100	150	mW
Beam Voltage	—	350	—	350	Vdc
Beam Current	—	48	—	48	mAdc
Reflector Voltage	—	−115	—	−210	Vdc
Bandwidth	40	45	40	45	Mc

BOMAC X-BAND KLYSTRONS

BL-841

8.0 to 9.0 kMc

BL-843

9.3 ±0.005 kMc

- *Metal Ceramic Construction*
- *High Stability*
- *Rugged*

A compact, rugged, reliable, fixed frequency reflex klystron designed for exceptional stability under severe environmental conditions. Leads molded in silicone rubber permit high altitude operation without pressurization. Has excellent temperature stability.

CHARACTERISTICS:

Frequency*	BL-841 8.0		BL-841 9.0		BL-843 9.3 ±0.005		kMc
	Min.	Avg.	Min.	Avg.	Min.	Avg.	
Power Output	10	18	10	18	30	40	mW
Beam Voltage	—	200	—	200	—	300	Vdc
Beam Current	—	12	—	12	—	35	mAdc
Reflector Voltage	—	−40	—	−90	—	−150	Vdc
Bandwidth	30	40	30	40	30	40	Mc

*Frequency of the BL-841 can be factory preset at any specified frequency between 8.0-9.0 kMc. In addition, ±20 Mc trimming is provided by means of the window flange screw.

BOMAC X-BAND KLYSTRON

BL-814

10.4 to 12.3 kMc

- *Simple Installation*
- *Lock Nut Tuning*

A medium power reflex klystron oscillator with lock nut tuning. Suitable for fixed frequency low power transmitters in the high X-band range. Top cap and base permit simple installation or replacement.

CHARACTERISTICS:

Frequency	10.4		12.3		kMc
	Min.	Avg.	Min.	Avg.	
Power Output	150	250	150	200	mW
Beam Voltage	—	400	—	400	Vdc
Beam Current	—	48	—	48	mAdc
Reflector Voltage	−270	−340	−310	−300	Vdc
Bandwidth	20	35	20	30	Mc

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PAGE 16 TO 19
PAGE 20 TO 25
PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

X-26
VA-113
VA-114
VA-115

V-58
V-58C
V-157
V-260
V-262
V-53B

V-290
V-54
V-55B

V-153
V-270
VA-6915

V-55
V-154

These reflex klystrons are gap-tuned tubes, employ single screw or lock nut type of tuning, and are furnished with either molded silicone rubber leads or with bases for plug-type connectors. All tubes illustrated have found wide application as radar local oscillators, in signal generator and laboratory service, and are rugged, dependable and suited to these uses. However, since newer designs offer superior performance characteristics and are to be preferred for new equipment designs, the tubes listed on pages 14 and 15 are now considered to be primarily for replacement purposes.

C-BAND OSCILLATOR

X-26 Series
5.3 to 7.5 kMc

- *Long Life*
- *Low Distortion*
- *Controlled Impedance Characteristics*
- *Uniform Performance*
- *Waveguide Output*

These well-known reflex klystrons are widely used as transmitters and local oscillators in microwave relay systems. They are also particularly suited for laboratory testing and for use as signal sources in test equipment. Conveniently tuned with single screw tuner. RF output mates with UG-344/U flange.

CHARACTERISTICS X-26E:

Frequency	5.3 Min.	5.3 Avg.	6.6 Min.	6.6 Avg.	kMc
Power Output	25	50	700	1650	mW
Beam Voltage	—	300	—	750	Vdc
Beam Current	—	19	—	70	mAdc
Reflector Voltage	—95	—140	—328	—400	Vdc
Bandwidth	15	24	28	48	Mc

MECHANICAL TUNING RANGE:

5.300-6.300 kMc	X-26F
5.300-6.600 kMc	X-26E
5.800-7.125 kMc	X-26D
6.300-7.500 kMc	X-26B

C-BAND OSCILLATORS

VA-113 5.925 to 6.575 kMc
VA-114 6.575 to 7.175 kMc
VA-115 7.175 to 7.725 kMc

The Varian VA-113, VA-114 and VA-115 are very long life reflex klystrons, intended for use as a source of C-band rf power in signal generators and other test and measurement equipment. The three klystrons in the series together cover the microwave spectrum between 5925 to 7725 Mc. Contact surfaces are provided on each end of the tube to facilitate attaching metal sleeves for housing rf filters. Physical appearance same as type X-26 series. Electrical characteristics have been optimized for signal generator service.

X-BAND OSCILLATOR

V-55
8.2 to 11.5 kMc

A ruggedized lock nut tuned wide band reflex klystron oscillator for use in low power fixed frequency transmitters or as a reliable local oscillator. Has built-in matching structure for maximum power into a matched load.

CHARACTERISTICS:

Frequency	8.2 Min.	8.2 Avg.	11.5 Min.	11.5 Avg.	kMc
Power Output	300	405	100	330	mW
Beam Voltage	—	500	—	500	Vdc
Beam Current	—	60	—	58	mAdc
Reflector Voltage	—130	—155	—	—280	Vdc
Bandwidth	40	60	—	45	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

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REFLEX KLYSTRONS

PRIMARILY FOR REPLACEMENT PURPOSES

X-BAND OSCILLATORS

V-55B
8.2 to 11.5 kMc

Identical to V-55 but with molded silicone rubber leads for high-altitude operation.

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-58C
8.5 to 10.0 kMc

This reflex klystron oscillator has a built-in matching transformer and provides maximum power into a matched load. It is provided with a single shaft tuner with low tuning rate and is easily adaptable to linear reflector voltage tracking. This tube is excellent for system applications and laboratory testing. Has gold-plated surfaces for attachment of rf shields.

CHARACTERISTICS:

Frequency	8.5 Min.	8.5 Avg.	9.3 Avg.	10.0 Avg.	kMc
Power	500	550	650	750	mW
Beam Voltage	—	500	500	500	Vdc
Beam Current	—	60	60	60	mAdc
Reflector Voltage	−200	−260	−320	−425	Vdc
Bandwidth	—	50	50	45	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-58
8.5 to 10.0 kMc

The V-58 is similar to the V-58C except for an additional lower reflector voltage mode specification, and does not have the gold-plated surfaces.

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-153/6315
8.5 to 10.0 kMc

The V-153 is a reflex klystron designed for improved operation at low resonator voltages. The single screw tuner provides ease of tuning and is easily reset.

CHARACTERISTICS:

Frequency	8.5 Min.	8.5 Avg.	10.0 Min.	10.0 Avg.	kMc
Power Output	10	60	30	90	mW
Beam Voltage	—	250	—	250	Vdc
Beam Current	—	30	—	30	mAdc
Reflector Voltage	−15	−60	−70	−120	Vdc
Bandwidth	43	55	43	55	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-157
8.5 to 10.0 kMc

A special X-band reflex klystron oscillator with electrical characteristics similar to the V-153/6315 but with 3-pin base. For new equipment design, the VA-201B or the VA-203B is recommended.

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-260/6310
8.5 to 10.0 kMc

A conveniently tuned reflex klystron oscillator used in radar local oscillator, signal generator, and laboratory applications. For new equipment design, the VA-201B or the VA-203B is recommended.

CHARACTERISTICS:

Frequency	8.5 Min.	8.5 Avg.	10.0 Min.	10.0 Avg.	kMc
Power Output	25	60	25	90	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	25	—	24	mAdc
Reflector Voltage	−85	−105	−160	−185	Vdc
Bandwidth	30	60	30	45	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

X-BAND OSCILLATORS

V-262
8.5 to 10.0 kMc

Reflex klystron oscillator, similar to V-260/6310 but with gold-plated surfaces for attachment of rf shields. Used primarily in signal generators.

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-270/6312
8.5 to 10.0 kMc

VA-6915
8.5 to 10.0 kMc

A versatile reflex klystron oscillator used principally in radar local oscillator applications. Electrically same as the V-260/6310 klystron. VA-6915 identical to V-270/6312 with addition of Viking connector.

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-290/6314
8.5 to 10.5 kMc

A rugged lock nut tuned reflex klystron oscillator intended for use in fixed frequency applications.

For new system designs, the VA-217C or VA-210B are recommended.

CHARACTERISTICS:

Frequency	8.5 Min.	8.5 Avg.	10.0 Min.	10.0 Avg.	kMc
Power Output	50	110	100	210	mW
Beam Voltage	—	350	—	350	Vdc
Beam Current	—	45	—	45	mAdc
Reflector Voltage	−85	−105	−170	−190	Vdc
Bandwidth	40	80	40	70	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-54
10.5 to 12.2 kMc

The V-54 reflex klystron was designed for local oscillator or low power transmitter use in fixed frequency applications. It provides an average matched power output of 200 mW with only 400 volts resonator voltage.

CHARACTERISTICS:

Frequency	10.5 Min.	10.5 Avg.	12.2 Min.	12.2 Avg.	kMc
Power Output	50	140	150	320	mW
Beam Voltage	—	400	—	400	Vdc
Beam Current	—	50	—	48	mAdc
Reflector Voltage	−120	−165	−270	−285	Vdc
Bandwidth	30	65	30	45	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-154
10.5 to 12.2 kMc

The V-154 is a stable, lock nut tuned reflex klystron for use in low power fixed frequency transmitter applications.

CHARACTERISTICS:

Frequency	10.5 Min.	10.5 Avg.	12.2 Min.	12.2 Avg.	kMc
Power Output	50	140	150	290	mW
Beam Voltage	—	400	—	400	Vdc
Beam Current	—	50	—	49	mAdc
Reflector Voltage	−120	−165	−270	−280	Vdc
Bandwidth	30	60	30	38	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

V-53B
10.7 to 11.7 kMc

The V-53B was designed for local oscillator or low power transmitter applications in the 10.7 to 11.7 kMc common carrier band.

CHARACTERISTICS:

Frequency	10.7 Min.	10.7 Avg.	11.7 Min.	11.7 Avg.	kMc
Power Output	25	55	25	85	mW
Beam Voltage	—	300	—	300	Vdc
Beam Current	—	27	—	27	mAdc
Reflector Voltage	−100	−140	−150	−190	Vdc
Bandwidth	25	50	25	40	Mc

This tube is also manufactured by Varian Associates of Canada, Ltd.

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PAGE 16 TO 19
PAGE 20 TO 25
PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

MEDIUM

VARIAN MEDIUM POWER KLYSTRONS FOR RELIABLE AIRBORNE RADAR

"Medium power" klystrons are rugged, compact, multi-cavity tubes which deliver output powers in the range from 1 watt to 100 watts. Klystrons in this family are used primarily as oscillators, amplifiers and frequency multipliers.

These tubes are ideally suited to either ground based or airborne fixed-frequency applications such as beacon, CW radar, pulsed radar or doppler radar navigational equipment. Other important applications for these medium-power klystrons include antenna pattern measurements, laboratory use and drivers for high-power klystrons. Although these tubes are primarily fixed-frequency devices, they may be factory preset to any required frequency within the range specified for each type.

Many pertinent features make these tubes particularly desirable for the applications stated above. These features include good to extremely good frequency stability, low noise characteristics, negligible microphonics, molded bases, and metal-ceramic construction. Frequency stability during operation is achieved by special designs which minimize changes in cavity geometry due to variations in temperature. Low noise and negligible microphonics result from the extreme care taken in the design of these tubes together with closely controlled fabrication techniques. Most of these types are equipped with silicone rubber bases molded to the tubes. This method of basing permits these devices to be operated at high altitudes without the need for pressurization. Some tubes in this family have metal and ceramic envelopes. This feature makes these tubes very rugged and ideal choices for use in environments where conditions of severe shock and vibration prevail.

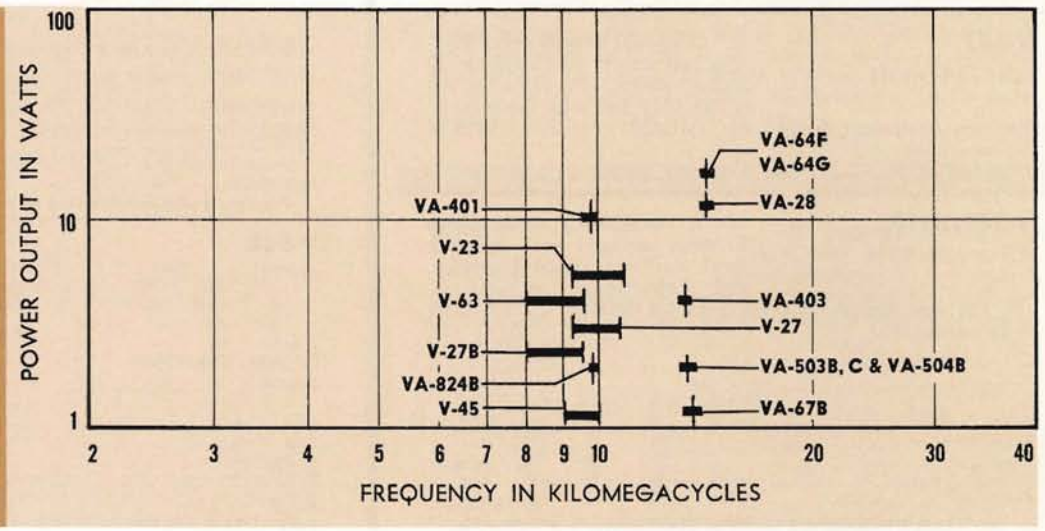
Included in the medium-power klystron family are three- and four-cavity tubes which currently operate at X-band and Ku-band. By means of advanced tuner designs and electrostatic focusing, the devices are very small and lightweight, yet provide ample power output for doppler radar navigational applications, for driving high-power klystrons, and for use as pump tubes for multiple parametric amplifiers.

The V-45 frequency multiplier is well suited to applications requiring low level crystal control for frequency stability. It provides X-band output and produces a frequency multiplication of 5:1 in a single tube. Frequency multipliers having other multiplication ratios and operating ranges can be developed.

Varian's Research and Development Department is constantly working on new products to meet the expanding governmental and commercial needs. Frequently, present designs can be modified to produce the characteristics needed for a particular application. If the medium-power klystrons included in this section do not meet your specific requirements, Varian Associates welcomes your inquiries for the development of tubes for new or existing applications.

LEGEND

Power Output & Frequency Range



POWER KLYSTRONS

ARRANGED BY FREQUENCY BANDS

X-BAND AMPLIFIER

V-27B

8.0 to 9.5 kMc

- *Extremely Rugged*
- *Low Microphonics*
- *Molded Base and Leads*

Very rugged, compact two-resonator klystron amplifier intended for medium-power fixed frequency transmitter operation, either CW or pulsed. Also suitable for synchrodyne operation. Molded base and leads permit high altitude operation without pressurization. Peak pulsed power output up to 400 watts. CW gain from 5 to 10.

CHARACTERISTICS, CW OPERATION:

Frequency	8.0 Avg.	8.8 Avg.	9.5 Avg.	kMc
Power Output (matched)	5.0	7.0	6.5	W
Power Output (optimum)	8.0	9.5	6.5	W
Drive Power	1.0	1.0	1.0	W
Beam Voltage	1250	1250	1250	Vdc
Beam Current	95	95	95	mAdc

X-BAND AMPLIFIER

V-27

9.1 to 11.0 kMc

- *Extremely Rugged*
- *Low Microphonics*
- *Molded Base and Leads*

Very rugged, compact two-resonator klystron amplifier intended for medium-power fixed frequency transmitter operation, either CW or pulsed. Also suitable for synchrodyne operation. Molded base and leads permit high altitude operation without pressurization. Peak pulsed power output up to 400 watts. CW gain from 5 to 10.

CHARACTERISTICS, CW OPERATION:

Frequency	9.1 Avg.	10.0 Avg.	11.0 Avg.	kMc
Power Output (matched)	2.5	7.0	5.5	W
Power Output (optimum)	5.5	7.5	5.5	W
Drive Power	1.0	1.0	1.0	W
Beam Voltage	1250	1250	1250	Vdc
Beam Current	100	100	100	mAdc

X-BAND OSCILLATOR

V-63

8.0 to 9.5 kMc

- *Frequency Stability*
- *High Power Output*
- *Low Noise*

A very rugged, compact two-resonator klystron oscillator ideally suited for beacon, fixed frequency radar, and navigational equipment transmitters either CW or pulsed. Molded silicone base and leads make this tube suitable for high altitude operation without pressurization. The high power output makes this tube very suitable for antenna pattern measurements and many other laboratory purposes. Provides peak power output up to 300 watts.

CHARACTERISTICS:

Frequency	8.0 Avg.	8.8 Avg.	9.5 Avg.	kMc
Power Output	2.5	5.0	6.5	W
Beam Voltage	800	1000	1260	Vdc
Beam Current	55	75	100	mAdc
Minimum Power	2.0	4.0	2.0	W

X-BAND OSCILLATOR

V-23

9.1 to 11.0 kMc

- *Frequency Stability*
- *High Power Output*
- *Low Noise*

A very rugged, compact two-resonator klystron oscillator ideally suited for beacon, fixed frequency radar, and navigational equipment transmitters either CW or pulsed. Molded silicone base and leads make the tube suitable for high-altitude operation without pressurization. The high power output makes this tube very suitable for antenna pattern measurements and many other laboratory purposes.

CHARACTERISTICS:

Frequency	9.1 Avg.	10.0 Avg.	11.0 Avg.	kMc
Power Output	3.0	6.5	4.5	W
Beam Voltage	920	1250	1250	Vdc
Beam Current	70	100	100	mAdc
Minimum Power	2.0	5.0	2.0	W

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MEDIUM

X-BAND AMPLIFIER

New

VA-401

9.79 to 9.81 kMc

- *Electrostatic Focusing*
- *High Gain*

The VA-401 is designed for rugged high altitude service and does not require pressurization. Light weight coupled with air cooling and electrostatic focusing facilitate installation and operation. The amplifier may be operated pulse or CW at 9.8 kilomegacycles.

CHARACTERISTICS, CW OPERATION:

Frequency	9.8		kMc
	Min.	Avg.	
Power Output, saturation	10	11	W
Beam Voltage	—	1000	Vdc
Beam Current	—	150	mAdc
Power Gain, saturated	28	30	db
Drive Power, saturated	5	15	mW

This tube is also manufactured by Varian Associates of Canada, Ltd.

Ku-BAND AMPLIFIER

New

VA-403

13.3 kMc

- *4 Cavity Klystron*
- *7 Watt CW Output*
- *28 db Saturated Gain*

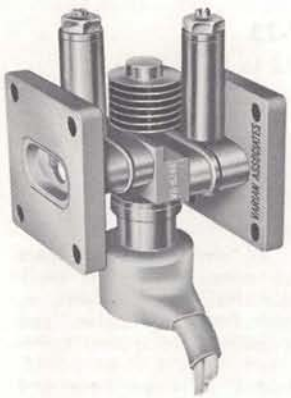
The VA-403 is a lightweight, electrostatically focused, air-cooled klystron amplifier for use in fixed frequency, CW radar or doppler navigational equipment transmitters and for phase coherent multiple parametric pump applications.

CHARACTERISTICS:

Frequency	13.3		kMc
	Min.	Avg.	
Power Output, saturation	5	7	W
Beam Voltage	—	1200	Vdc
Beam Current	—	190	mAdc
Power Gain, saturation	25	28	db

This tube is also manufactured by Varian Associates of Canada, Ltd.

X-BAND AMPLIFIER



VA-824B

9.78 to 9.82 kMc

- *Electrostatic Focusing*

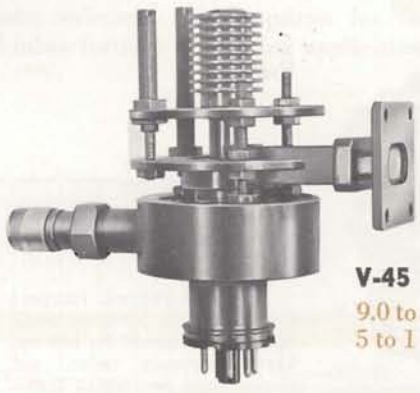
The VA-824B is an extremely rugged medium power amplifier designed specifically for CW amplification, pulse modulated amplification, and synchrodyne operation. Low temperature coefficient, light weight, and ability to endure severe environmental test clearly indicate the tube's airborne aptitude. Provides average gain of 10 db.

CHARACTERISTICS:

Frequency	9.80		kMc
	Min.	Avg.	
Power Output, saturation	2.0	2.30	W
Beam Voltage	—	750	Vdc
Beam Current	—	52	mAdc
Power Gain, saturated	7	10.0	db
Drive Power, saturated	—	0.360	W

This tube is also manufactured by Varian Associates of Canada, Ltd.

L/X-BAND MULTIPLIER



V-45

9.0 to 10.0 kMc
5 to 1 Multiplier

A rugged, frequency multiplier designed as a driver for medium and high power X-band amplifiers. Well suited for applications requiring low level crystal control for frequency stability. Has good stability over wide temperature range.

CHARACTERISTICS:

	Avg.	Avg.	
Input Frequency	1.86	1.86	kMc
Output Frequency	9.3	9.3	kMc
Resonator Voltage	650	1000	Vdc
Resonator Current	30	66	mAdc
Drive Power	1	3	W
Power Output, avg	280	1150	mW
Power Output, min	150	—	mW

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POWER KLYSTRONS

ARRANGED BY FREQUENCY BANDS

Ku-BAND OSCILLATORS

New

VA-503B
13.5 kMc

VA-503C
13.3 kMc

- *High Altitude Operation*

The VA-503B and VA-503C are extremely rugged, compact, medium power, air-cooled, two-resonator klystron oscillators particularly suited for fixed frequency doppler radar navigation applications.

CHARACTERISTICS, VA-503B, VA-503C:

	13.5		13.3		
Frequency	Min.	Avg.	Min.	Avg.	kMc
Power Output	1	2	1	2	W
Beam Voltage	*1500	1600	1500	1600	Vdc
Beam Current	16	26	16	26	mAdc

Ku-BAND OSCILLATOR

New

VA-504B
13.3 kMc

- *Low Noise and Microphonics*
- *Compact, Light Weight*
- *Stable*

The VA-504B is an extremely rugged, liquid-cooled, medium power, two-resonator klystron oscillator for fixed frequency doppler radar navigation and similar applications.

CHARACTERISTICS:

	13.3		
Frequency	Min.	Avg.	kMc
Power Output	15	19	W
Beam Voltage	—	3000	Vdc
Beam Current	60	70	mAdc
Beam Modulation Coefficient	—	30	kc/V

Ku-BAND OSCILLATORS

VA-64F
13.5 kMc

VA-64G
13.3 kMc

- *Extreme Frequency Stability*

The VA-64F and VA-64G are extremely rugged, compact, high power, liquid-cooled, two-resonator klystrons particularly suited for fixed frequency doppler radar navigation applications.

CHARACTERISTICS, VA-64F, VA-64G:

	13.5		13.3		
Frequency	Min.	Avg.	Min.	Avg.	kMc
Power Output	15	18	15	18	W
Beam Voltage	—	3000	—	3000	Vdc
Beam Current	60	72	60	72	mAdc

Ku-BAND OSCILLATOR

VA-28
13.35 to 13.65 kMc

- *Frequency Stability*
- *Low Noise*

Small, very rugged, compact, two-resonator klystron oscillator, designed for use in fixed frequency, CW radar or navigational equipment transmitters. May be operated at unlimited altitude without pressurization. These tubes have low noise and microphonics.

CHARACTERISTICS:

Frequency	13.5 kMc
Beam Voltage	2950 Vdc
Beam Current	70 mAdc
Power Output, avg.	14 W
Power Output, min.	10 W

Ku-BAND OSCILLATOR

VA-67B
13.35 to 13.65 kMc

- *Frequency Stability*
- *Low Noise*

Small, very rugged, compact, two-resonator klystron oscillator, designed for use in fixed frequency, CW radar or navigational equipment transmitters. May be operated at unlimited altitude without pressurization. These tubes have low noise and microphonics.

CHARACTERISTICS:

Frequency	13.5 kMc
Beam Voltage	1600 Vdc
Beam Current	28 mAdc
Power Output, avg.	1 W
Power Output, min.	0.75 W

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

CW POWER

VARIAN CW POWER KLYSTRONS ASSURE SIMPLE, TROUBLE-FREE SYSTEM OPERATION

Varian CW power klystrons simplify installation and minimize operating adjustments. Thorough technical design and meticulous quality control permit many adjustments to be set permanently at the factory.

Internal cavities eliminate sliding contacts, contacting surfaces, rf leakage and consequent regeneration, insulator breakdown, expensive maintenance, and costly failures.

Noncritical magnetic focusing structures provide adjustment-free tube mounts, automatic centering of the beam, fewer electrical adjustments, and low spurious and operating noise.

Optimum technical design provides wide tuning ranges, broad bandwidths, low AM and phase distortion, operation with flat input and output lines without adjustments, high gain, and high efficiency.

Elimination of multiple operating adjustments minimizes errors, saves time, and reduces the possibility of accidental damage to the klystron.

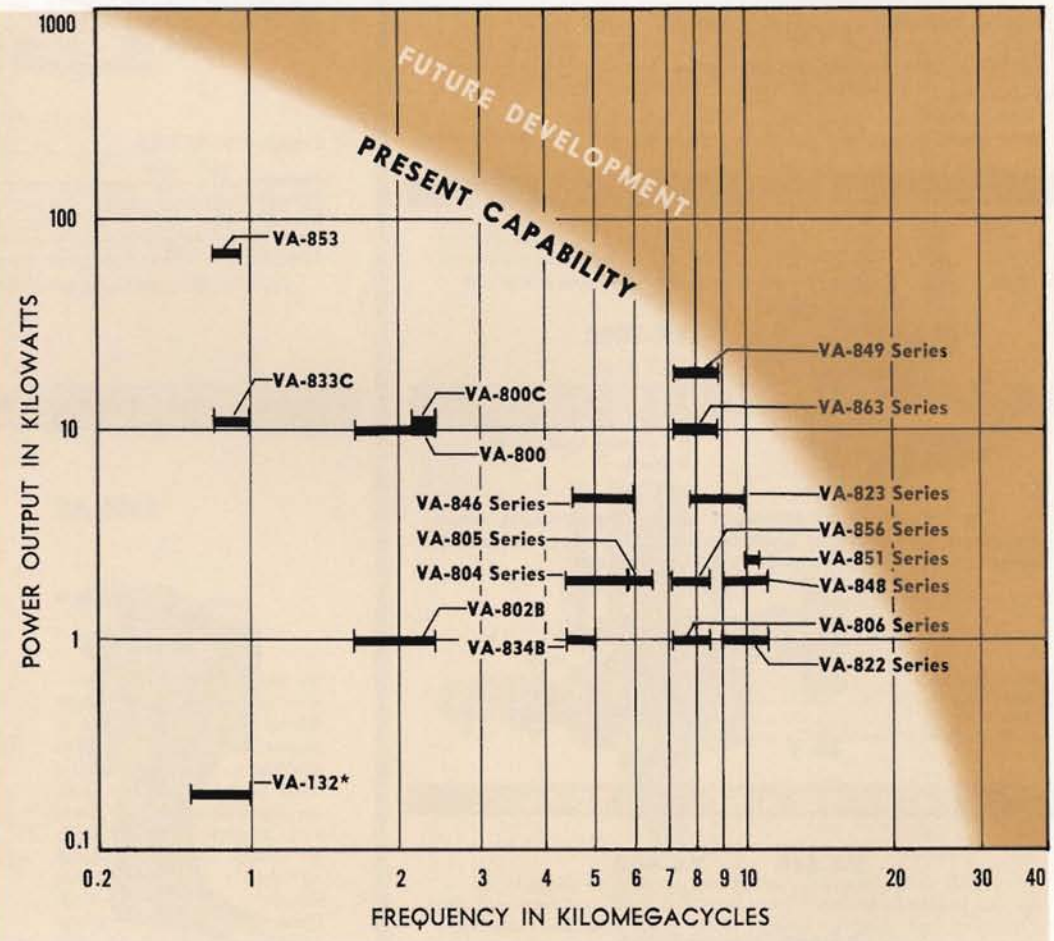
Conservative designs provide protection against abuse, insure reliability in service, result in the shortest time to restore service after power source failures, and assure the lowest over-all operating costs.

TUBE NO.	PAGE
VA-132*	38
VA-800	22
VA-800C	22
VA-802B	22
VA-804 Series	23
VA-805 Series	23
VA-806 Series	24
VA-822 Series	25
VA-823 Series	25
VA-833C	21
VA-834B	23
VA-846 Series	23
VA-848 Series	25
VA-849 Series	24
VA-851 Series	25
VA-853	21
VA-856 Series	24
VA-863 Series	24

*TWT

LEGEND

Power Output & Frequency Range



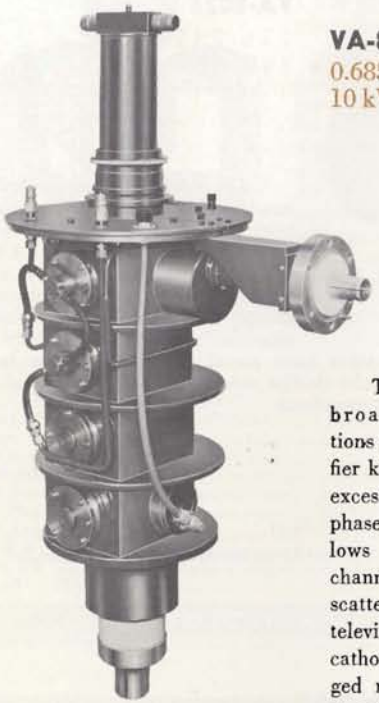
PRODUCTS FROM RESEARCH AND DEVELOPMENT

Varian's research and development laboratories have demonstrated the ability to produce new CW power amplifier tubes for many power and frequency ranges. Over 200 skilled engineers and scientists are rapidly advancing the state of the art in microwave tubes. Fundamental research in components provides the foundation for Varian's leadership.

KLYSTRONS

ARRANGED BY FREQUENCY BANDS

UHF CW AMPLIFIER



VA-833C

0.685 to 0.985 kMc
10 kW CW

The VA-833C is a broadband communications and television amplifier klystron. Bandwidth in excess of 7 Mc with linear phase characteristics allows 240 four-kilocycle channels of FM forward scatter service or color television. A conservative cathode design and rugged maintenance-free construction provide long, low-cost, reliable life. Tube allows immediate automatic reapplication of full voltages to restore service after power line interruptions.

CHARACTERISTICS:

Frequency, tunable	0.685-0.985 kMc
Power Output	10 kW
Gain (stagger tuned)	43 db
Bandwidth (stagger tuned)	7 Mc
Beam Voltage	12.5 kVdc
Beam Current	2.7 Adc
Dimensions	14½ x 21½ x 41 in
Weight	200 lb
Cooling	Liquid and Forced Air
Focusing	VA-1521C Electromagnet

VA-1521C ELECTROMAGNET

Focusing Electromagnet for VA-833C

Power Requirement	1330 W
Dimensions	22½ dia x 23½ in
Weight	350 lb
Cooling	Liquid

UHF CW AMPLIFIER

New

VA-853

0.755 to 0.985 kMc
75 kW CW

The VA-853 high-power high-gain CW amplifier klystron is designed for multichannel high quality communication service. This tube operates from standard 5-watt exciter units and provides wideband linear amplification.

CHARACTERISTICS:

Frequency, tunable	0.755-0.985 kMc
Power Output	75 kW
Gain (tuned for high efficiency)	50 db
Bandwidth (tuned for high efficiency)	7 Mc
Beam Voltage	26 kVdc
Beam Current	8.3 Adc
Dimensions	24 x 30 x 60½ in
Weight	200 lb
Cooling	Liquid and Forced Air
Focusing	VA-1553 Electromagnet

VA-1553 ELECTROMAGNET

Focusing Electromagnet for VA-853

Power Requirement	3200 W
Dimensions	24 x 24 x 32¾ in
Weight	840 lb
Cooling	Liquid

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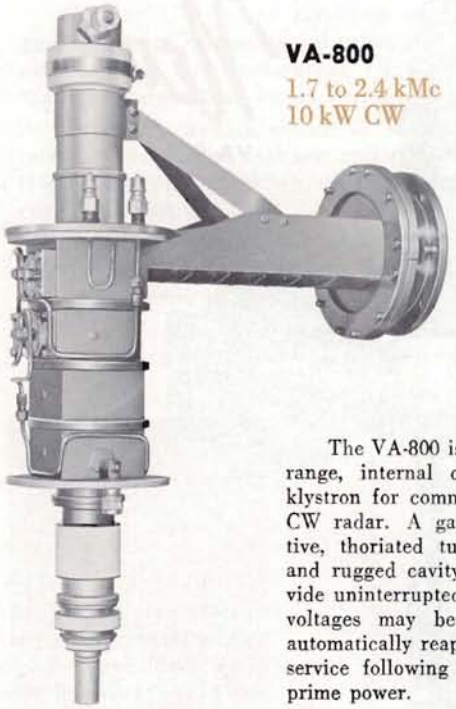
PAGE 20 TO 25
PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

C W P O W E R

S-BAND CW AMPLIFIER



VA-800

1.7 to 2.4 kMc
10 kW CW

The VA-800 is a wide-tuning-range, internal cavity amplifier klystron for communications and CW radar. A gas-free conservative, thoriated tungsten cathode and rugged cavity structure provide uninterrupted long life. Full voltages may be instantly and automatically reapplied to restore service following interruption of prime power.

CHARACTERISTICS:

Frequency, Tunable	1.7-2.4 kMc
Power Output	10 kW
Gain (stagger tuned)	40 db
Bandwidth (stagger tuned)	8 Mc
Beam Voltage	16 kVdc
Beam Current	2 Adc
Dimensions	7½ x 18 x 27 in
Weight	50 lb
Cooling	Liquid and Forced Air
Focusing	VA-1520 Electromagnet

VA-1520 ELECTROMAGNET

Focusing Electromagnet for VA-800

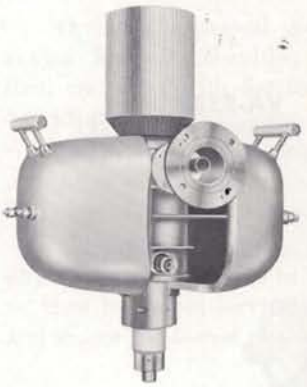
Power Requirement	1250 W
Dimensions	11½ x 15⅛ x 15½ in
Weight	225 lb
Cooling	Liquid

VA-1502 ELECTROMAGNET

Focusing Electromagnet for VA-800C

Power Requirement	1300 W
Dimensions	15 x 15 x 15 in
Weight	125 lb
Cooling	Liquid

S-BAND CW AMPLIFIER



VA-802B

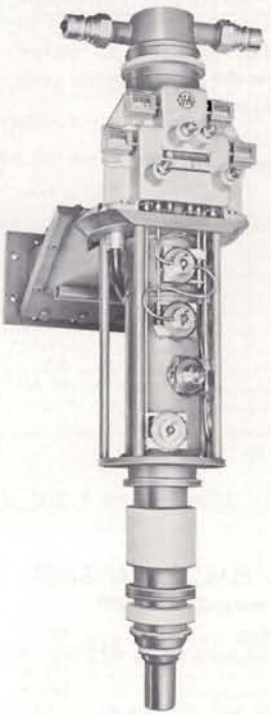
1.7 to 2.4 kMc
1 kW CW

The VA-802B is an air-cooled amplifier klystron with permanent magnet focusing for transportable communications and CW radar. Rugged structures and elimination of all adjustments except tuning provide a reliable amplifier with great simplicity of operation. A conservative hard metal cathode provides long life, and noncritical tube design allows instant fault recycling after power source interruptions.

CHARACTERISTICS:

Frequency, Tunable	1.7-2.4 kMc
Power Output	1 kW
Gain (tuned for high efficiency)	40 db
Bandwidth (tuned for high efficiency)	6 Mc
Beam Voltage	6 kVdc
Beam Current	0.5 Adc
Dimensions	14¾ x 15 x 18¼ in
Weight	85 lb
Cooling	Forced Air
Focusing	Permanent Magnet

S-BAND CW AMPLIFIER



VA-800C

2.16 to 2.40 kMc
10 kW CW

Predecessor to the wide tuning range VA-800, the VA-800C is a rugged amplifier klystron used in forward scatter communications, CW radar, and industrial heating. Continuous tuning with indicating counters is provided over a 240-Mc range. Conservatively rated thoriated tungsten cathode and tungsten filament provide long, trouble-free tube life. Automatic immediate restoration of service following a power line interruption is permitted.

CHARACTERISTICS:

Frequency, Tunable	2.16-2.40 kMc
Power Output	11 kW
Gain (stagger tuned)	40 db
Bandwidth (stagger tuned)	8 Mc
Beam Voltage	15 kVdc
Beam Current	1.85 Adc
Dimensions	7 x 14½ x 26 in
Weight	38 lb
Cooling	Liquid and Forced Air
Focusing	VA-1502 Electromagnet

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

KLYSTRONS

ARRANGED BY FREQUENCY BANDS

C-BAND CW AMPLIFIER

VA-834B

4.4 to 5.0 kMc
1 kW CW

The VA-834B is an air-cooled amplifier klystron with permanent magnet focusing for transportable communications and CW radar. Rugged structures and elimination of all adjustments except tuning provide a reliable amplifier with great simplicity of operation. A conservative hard metal cathode provides long life.

CHARACTERISTICS:

Frequency, Tunable	4.4-5.0 kMc
Power Output	1.3 kW
Gain (tuned for high efficiency)	46 db
Bandwidth (tuned for high efficiency)	7.5 Mc
Beam Voltage	7.5 kVdc
Beam Current	0.47 Adc
Dimensions	12 x 13 x 15½ in
Weight	60 lb
Cooling	Forced Air
Focusing	Permanent Magnet

This tube is also manufactured by Varian Associates of Canada, Ltd.

C-BAND CW AMPLIFIER

VA-804 Series

4.400 to 5.875 kMc
2 kW CW

Tubes in the VA-804 series are liquid-cooled four-cavity amplifier klystrons for communication and CW radar service. Each klystron is tunable with a single shaft for each resonant cavity. Tubes are simple to adjust and suited to low noise amplifier service.

CHARACTERISTICS:

Frequency	4.400-5.875 kMc
Tuning Range	150 Mc
Power Output	2 kW
Gain (tuned for high efficiency)	45 db
Bandwidth (tuned for high efficiency)	8 Mc
Beam Voltage	9 kVdc
Beam Current	0.75 Adc
Dimensions	9 x 9 x 19 in
Weight	14 lb
Cooling	Liquid and Forced Air
Focusing	VA-1504 Electromagnet

This tube is also manufactured by Varian Associates of Canada, Ltd.

VA-1504 ELECTROMAGNET

Focusing Electromagnet for VA-804

Power Requirement	480 W
Dimensions	12 x 12⅝ x 18¾ in
Weight	200 lb
Cooling	Liquid

This magnet is also manufactured by Varian Associates of Canada, Ltd.

C-BAND CW AMPLIFIER

VA-846 Series

4.4 to 6.0 kMc
5 kW CW

Tubes of the VA-846 Series are four-cavity liquid-cooled amplifier klystrons for low noise CW radar, illuminator, and communication services. Both AM and FM tube noise have been reduced by new design techniques.

CHARACTERISTICS:

Frequency	4.4-6.0 kMc
Tuning Range	150 Mc
Power Output	5 kW
Gain (tuned for high efficiency)	44 db
Bandwidth (tuned for high efficiency)	8 Mc
Beam Voltage	12.5 kVdc
Beam Current	1.28 Adc
Dimensions	8¼ x 9½ x 21½ in
Weight	20. lb
Cooling	Liquid and Forced Air
Focusing	VA-1546 Electromagnet

This tube is also manufactured by Varian Associates of Canada, Ltd.

VA-1546 ELECTROMAGNET

Focusing Electromagnet for VA-846

Power Requirement	500 W
Dimensions	10⅞ x 14 x 16 in
Weight	200 lb
Cooling	Liquid

This magnet is also manufactured by Varian Associates of Canada, Ltd.

C-BAND CW AMPLIFIER

VA-805 Series

5.875 to 6.425 kMc
2 kW CW

The VA-805 Series are liquid-cooled four-cavity amplifier klystrons for communications and CW radar service. Each klystron is tunable with a single shaft for each resonant cavity. Tubes are simple to adjust and suited to low noise amplifier service.

CHARACTERISTICS:

Frequency	5.875-6.425 kMc
Tuning Range	50 Mc
Power Output	2 kW
Gain (tuned for high efficiency)	45 db
Bandwidth (tuned for high efficiency)	10 Mc
Beam Voltage	9 kVdc
Beam Current	0.75 Adc
Dimensions	7¼ x 8⅛ x 19 in
Weight	12 lb
Cooling	Liquid and Forced Air
Focusing	VA-1505 Electromagnet

VA-1505 ELECTROMAGNET

Focusing Electromagnet for VA-805

Power Requirement	450 W
Dimensions	11⅝ x 12¾ x 18¾ in
Weight	200 lb
Cooling	Liquid

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PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

CW POWER

X-BAND CW AMPLIFIER

VA-849 Series

7.125 to 8.500 kMc
20 kW CW

The VA-849 delivers more CW power in X-band than any other tube. This tube which contributes very little noise is used as the final power amplifier in transmitters of very long range systems. Applications include earth-to-satellite communication, radar astronomy, missile illumination, and orbital scatter communication.

CHARACTERISTICS:

Frequency	7.125-8.500 kMc
Tuning Range	60 Mc
Power Output	23.5 kW
Gain (tuned for high efficiency)	43.7 db
Bandwidth (tuned for high efficiency)	29 Mc
Beam Voltage	23 kVdc
Beam Current	2.7 Adc
Dimensions	4 x 6 x 18 in
Weight	14 lb
Cooling	Water
Focusing	VA-1549 Electromagnet

VA-1549 ELECTROMAGNET

Focusing electromagnet for VA-849

Power Requirement	1520 W
Dimensions	12½ x 15¼ x 16 in
Weight	200 lb
Cooling	Water

X-BAND CW AMPLIFIER

VA-806 Series

7.5 to 8.5 kMc
1 kW CW

Tubes in the VA-806 series are liquid-cooled four-cavity amplifier klystrons for communication and CW radar service. For new equipment designs use the VA-856.

CHARACTERISTICS:

Frequency	7.5-8.5 kMc
Tuning Range	50 Mc
Power Output	1 kW
Gain (synchronously tuned)	50 db
Bandwidth (synchronously tuned)	14 Mc
Beam Voltage	8 kVdc
Beam Current	0.64 Adc
Dimensions	4½ x 5¾ x 12 in
Weight	3¼ lb
Cooling	Water
Focusing	VA-1506B Electromagnet

VA-1506B ELECTROMAGNET

Focusing Electromagnet for VA-806

Power Requirement	450 W
Dimensions	6⅝ x 11⅛ x 12¼ in
Weight	60 lb
Cooling	Water

X-BAND CW AMPLIFIER

VA-856 Series

7.125 to 8.500 kMc
2 kW CW

The VA-856 tubes are four-cavity liquid-cooled amplifier klystrons for communication, low noise CW radar, and illuminator services. Four tubes cover the frequency range. Tubes are simple to tune and adjust.

CHARACTERISTICS:

Frequency	7.125-8.500 kMc
Tuning Range	
7.125-7.730 kMc	300 Mc
7.700-8.500 kMc	400 Mc
Power Output	2 kW
Gain (tuned for high efficiency)	47 db
Bandwidth (tuned for high efficiency)	15 Mc
Beam Voltage	9.5 kVdc
Beam Current	0.8 Adc
Dimensions	4½ x 7⅛ x 14 in
Weight	6 lb
Cooling	Liquid
Focusing	VA-1556 Electromagnet

VA-1556 ELECTROMAGNET

Focusing Electromagnet for VA-856

Power Requirement	800 W
Dimensions	7⅝ x 11¼ x 12¼ in
Weight	75 lb
Cooling	Liquid

X-BAND CW AMPLIFIER

VA-863 Series

7.125 to 8.500 kMc
10 kW CW

VA-863 tubes are four-cavity liquid-cooled amplifier klystrons for low noise CW radar, illuminator, and communication services. High power, high gain, low noise and good stability make possible radar performance not attainable previously.

CHARACTERISTICS:

Frequency	7.125-8.500 kMc
Tuning Range	60 Mc
Power Output	10 kW
Gain (tuned for high efficiency)	40 db
Bandwidth (tuned for high efficiency)	20 Mc
Beam Voltage	17 kVdc
Beam Current	1.7 Adc
Dimensions	4 x 7 x 16 in
Weight	8 lb
Cooling	Liquid
Focusing	VA-1563 Electromagnet

VA-1563 ELECTROMAGNET

Focusing Electromagnet for VA-863

Power Requirement	500 W
Dimensions	11 x 14 x 16 in
Weight	200 lb
Cooling	Liquid

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KLYSTRONS

ARRANGED BY FREQUENCY BANDS

X-BAND CW AMPLIFIER

VA-823 Series
7.5 to 10.0 kMc
5 kW CW

Tubes of the VA-823 Series are four-cavity liquid-cooled amplifier klystrons for low noise CW radar, illuminator, and communication services. The high power, high gain, low noise and stability make possible radar performance not attainable previously.

CHARACTERISTICS:

Frequency	7.5-10.0 kMc
Tuning Range	
7.5-9.0 kMc	100 Mc
9.0-10.0 kMc	200 Mc
Power Output	8.8 kW
Gain (tuned for high efficiency)	43 db
Bandwidth (tuned for high efficiency)	20 Mc
Beam Voltage	15 kVdc
Beam Current	1.4 Adc
Dimensions	3-9/16 x 7 x 15 in
Weight	6 lb
Cooling	Liquid
Focusing	VA-1523 Electromagnet

VA-1523 ELECTROMAGNET
Focusing Electromagnet for VA-823

Power Requirement	500 W
Dimensions	11 x 14 x 16 in
Weight	200 lb
Cooling	Liquid

X-BAND CW AMPLIFIER

VA-848 Series
9.0 to 10.8 kMc
2 kW CW

Tubes in the VA-848 Series are four-cavity liquid-cooled amplifier klystrons for low noise CW radar, illuminator, and communication services. Permanent magnet focusing makes operation easy and simplifies the associated equipment.

CHARACTERISTICS:

Frequency	9.0-10.8 kMc
Tuning Range	200 Mc
Power Output	2 kW
Gain (synchronously tuned)	50 db
Bandwidth (synchronously tuned)	12 Mc
Beam Voltage	10 kVdc
Beam Current	0.8 Adc
Dimensions	3¾ x 5¾ x 14 in
Weight	27 lb
Cooling	Liquid
Focusing	Permanent Magnet

X-BAND CW AMPLIFIER

VA-822 Series
9.0 to 11.0 kMc
1 kW CW

Tubes in the VA-822 Series are four-cavity liquid-cooled amplifier klystrons for low noise CW radar, illuminator, and communication services. Noise specifications apply under vibration to 500 cycles at 2G while operating. Permanent magnet focusing and rugged construction make the tubes suitable for severe environments.

CHARACTERISTICS:

Frequency	9.0-11.0 kMc
Tuning Range	
9.0-10.0 kMc	200 Mc
10.0-11.0 kMc	250 Mc
Power Output	1.45 kW
Gain (tuned for high efficiency)	43 db
Bandwidth (tuned for high efficiency)	20 Mc
Beam Voltage	8 kVdc
Beam Current	0.585 Adc
Dimensions	5 x 8 x 11 in
Weight	17 lb
Cooling	Liquid
Focusing	Permanent Magnet

X-BAND CW AMPLIFIER

New

VA-851 Series
9.20 to 10.55 kMc
2.5 kW CW

Tubes of the VA-851 Series of CW amplifier klystrons are for light weight CW radar and illuminator service. Contributed noise in any 1-kc channel more than 1 kc from carrier is at least 100 db down. Driving power requirements are flexible. The tube has an integral permanent magnet for focusing and is liquid cooled.

CHARACTERISTICS:

Frequency	9.20-10.55 kMc
Tuning Range	250 Mc
Power Output	2.5 kW
Gain (tuned for high efficiency)	28 db
Bandwidth (tuned for high efficiency)	37 Mc
Beam Voltage	10.5 kVdc
Beam Current	0.95 Adc
Dimensions	6¾ x 10¼ x 11 in
Weight	30 lb
Cooling	Liquid
Focusing	Permanent magnet

This tube is also manufactured by Varian Associates of Canada, Ltd.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

PAGE 26 TO 30
PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

VARIAN PULSE POWER KLYSTRONS MAKE MODERN RADAR PRACTICAL

Varian pulse power klystrons are designed to be noncritical in operation with minimum operating adjustments.

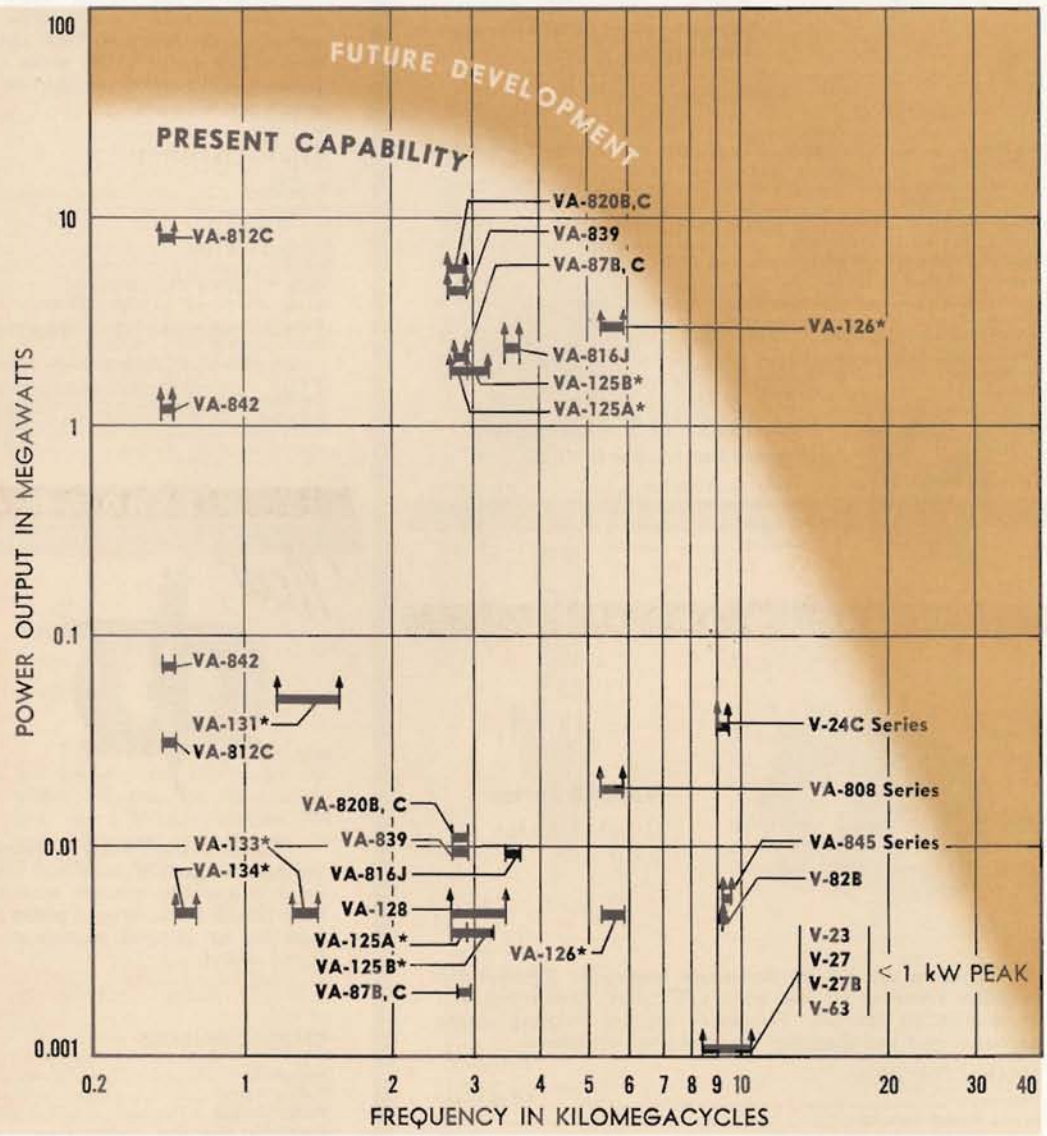
Stable, high-gain amplifier performance with low noise and good phase coherence and linearity are inherent in Varian pulse klystrons. Faithful reproduction of the frequency and phase of the driving signal permits full use of sophisticated radar techniques.

The electron beam dissipates its residual energy on the collector and not on the rf circuit elements. The cathode temperature remains constant because it is not bombarded and heated by returning electrons. These features combined with high efficiency make these pulse klystrons rugged and reliable, with long life and low operating cost.

LEGEND

Peak Power & Frequency Range

Average Power & Frequency Range



PRODUCTS FROM RESEARCH AND DEVELOPMENT

Varian's research and development laboratories are rapidly advancing the state of the art in high power pulse amplifier tubes. Over 200 engineers and scientists are working on new developments in microwave tubes. Leadership in basic research has resulted in the world's largest reliable pulse amplifier klystrons.

POWER KLYSTRONS

ARRANGED BY FREQUENCY BANDS

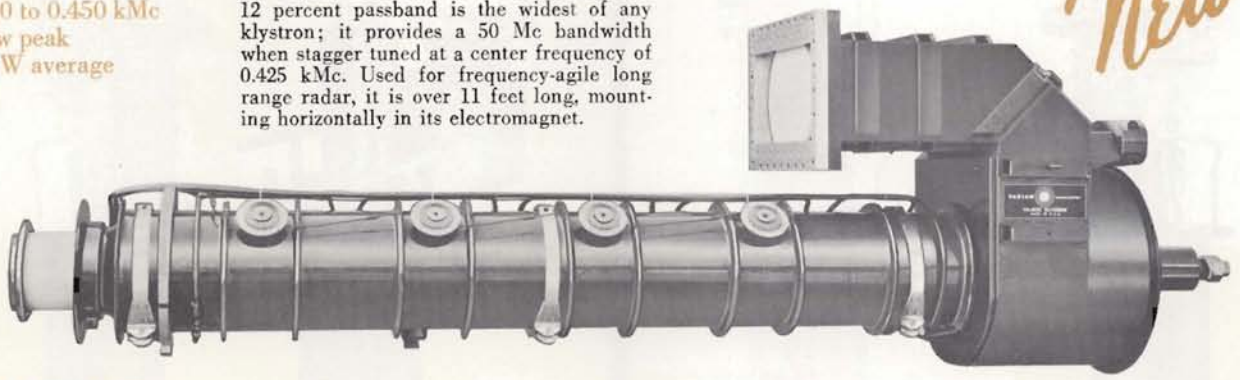
UHF PULSE AMPLIFIER KLYSTRONS

VA-812C

0.400 to 0.450 kMc
8 Mw peak
30 kW average

The VA-812C broadband pulse amplifier klystron is the world's largest tube. Its 12 percent passband is the widest of any klystron; it provides a 50 Mc bandwidth when stagger tuned at a center frequency of 0.425 kMc. Used for frequency-agile long range radar, it is over 11 feet long, mounting horizontally in its electromagnet.

New



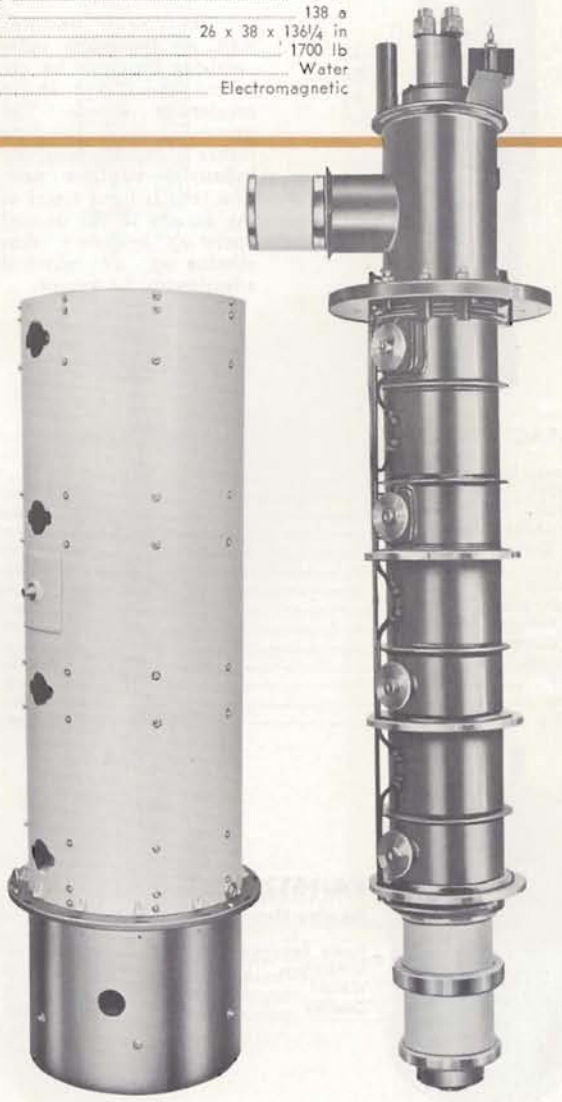
CHARACTERISTICS:

Frequency, Tunable	0.400-0.450 kMc	Beam Voltage, Peak	145 kv
Power Output, Peak	8 Mw	Beam Current, Peak	138 a
Power Output, Avg.	30 kW	Dimensions	26 x 38 x 136¼ in
Gain (stagger tuned)	30 db	Weight	1700 lb
Bandwidth (stagger tuned)	50 Mc	Cooling	Water
Pulse Duration	6 μsec	Focusing	Electromagnetic

VA-842

0.400 to 0.450 kMc
1.25 Mw peak
75 kW average

The VA-842 is a four-cavity pulse amplifier klystron for long range and missile tracking radar. A modulating electrode operating at half beam voltage and low current permits pulse formation with low modulating power. Pulse lengths up to 2 milliseconds may be employed. Stainless steel, ceramic construction, and internal cavities make a rugged, strong, simple unit.



CHARACTERISTICS:

Frequency, Tunable	0.400-0.450 kMc
Tuning Range	50 Mc
Power Output, Peak	1.25 Mw
Power Output, Avg.	75 kW
Gain (tuned for high efficiency)	41 db
Bandwidth (tuned for high efficiency)	3 Mc
Pulse Duration	2000 μsec
Beam Voltage	100 kVdc
Beam Current, Peak	29 a
Modulating Anode Voltage, Peak	55 kv
Dimensions	24 x 33 x 120 in
Weight	840 lb
Cooling	Water and Air
Focusing	VA-1542 Electromagnet

VA-1542 ELECTROMAGNET

Focusing Electromagnet for VA-842

Power Requirement	2600 W
Dimensions	28¾ dia x 84½ in
Weight	2000 lb
Cooling	Water

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

S-BAND PULSE AMPLIFIER

VA-820B, C

2.7 to 2.9 kMc
5 Mw peak
10 kW average

The VA-820B and VA-820C are four-cavity pulse amplifier klystrons for coherent radar and linear accelerator service. The proven, rugged structure makes a reliable long life industrial amplifier unit. The tube is fixed tuned at the factory to the desired operating frequency thus eliminating all physical adjustments in service.

CHARACTERISTICS:

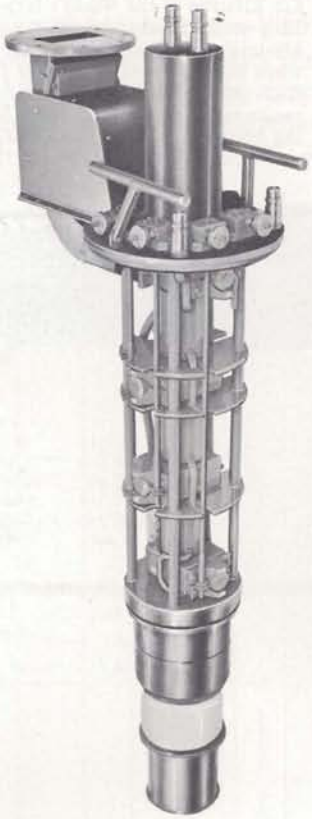
Frequency Ranges:	
VA-820B, Fixed Tuned	2.7-2.8 kMc
VA-820C, Fixed Tuned	2.8-2.9 kMc
Power Output, Peak	5 Mw
Power Output, Avg.	10 kW
Gain	50 db
Bandwidth	25 Mc
Pulse Duration	7 μsec
Beam Voltage, Peak	130 kv
Beam Current, Peak	94 a
Dimensions	8⅛ x 10 x 41¾ in
Weight	61 lb
Cooling	Water
Focusing	VA-1512 Electromagnet

VA-1512 ELECTROMAGNET

Focusing Electromagnet for VA-820B, C

Power Requirement	1500 W
Dimensions	15 dia x 22½ in
Weight	475 lb
Cooling	Water

S-BAND PULSE AMPLIFIER



VA-87B, C

2.7 to 2.9 kMc
2 Mw peak
2 kW average

The VA-87B and VA-87C are four-cavity pulse amplifier klystrons for coherent radar and linear accelerator service. The simple rugged structure makes a reliable amplifier with high gain and low phase distortion. The VA-87 mounts in a self-centering magnet structure with no adjustments required.

CHARACTERISTICS:

Frequency Ranges:	
VA-87B, Tunable	2.7-2.8 kMc
VA-87C, Tunable	2.8-2.9 kMc
Power Output, Peak	2.0 Mw
Power Output, Avg.	2.0 kW
Gain (tuned for high efficiency)	55 db
Bandwidth (tuned for high efficiency)	20 Mc
Pulse Duration	6 μsec
Beam Voltage, Peak	110 kv
Beam Current, Peak	64 a
Dimensions	8⅛ x 14 x 38¼ in
Weight	65 lb
Cooling	Liquid
Focusing	VA-1503B Electromagnet

VA-1503B ELECTROMAGNET

Focusing Electromagnet for VA-87B, C

Power Requirement	760 W
Dimensions	15 dia x 22½ in
Weight	300 lb
Cooling	Water

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POWER KLYSTRONS

ARRANGED BY FREQUENCY BANDS

S-BAND PULSE AMPLIFIER

VA-839

2.73 to 2.87 kMc
4 Mw peak
10 kW average

The VA-839 is a seven-cavity, wideband, fixed-tuned pulse amplifier klystron for frequency agile coherent radar service. The seven cavities are stagger tuned at the factory to provide a 140 Mc bandwidth with high gain and high efficiency. No tuning or rf adjustments in service are required.

CHARACTERISTICS:

Frequency, Fixed Tuned	2.73-2.87 kMc
Power Output, Peak	5 Mw
Power Output, Avg.	10 kW
Gain	45 db
Bandwidth (at 4 Mw)	140 Mc
Pulse Duration	7 μsec
Beam Voltage, Peak	125 kv
Beam Current, Peak	93 a
Dimensions	8 x 10 x 45 in
Weight	70 lb
Cooling	Water
Focusing	VA-1539 Electromagnet

VA-1539 ELECTROMAGNET

Focusing Electromagnet for VA-839

Power Requirement	1600 W
Dimensions	15 dia x 24 in
Weight	510 lb
Cooling	Water

S-BAND PULSE AMPLIFIERS

VA-816J

3.43 to 3.57 kMc
2.5 Mw peak
9 kW average

The VA-816J is a five-cavity tunable pulse amplifier klystron for coherent radar and linear accelerator services. The five cavities provide high efficiency and high amplification. Rugged simple structure gives this tube long and reliable life.

CHARACTERISTICS:

Frequency, Tunable	3.43-3.57 kMc
Power Output, Peak	2.5 Mw
Power Output, Avg.	9 kW
Gain (stagger tuned)	64 db
Pulse Duration	12 μsec
Beam Voltage, Peak	115 kv
Beam Current, Peak	78 a
Dimensions	8 x 10 x 42 in
Weight	65 lb
Cooling	Water
Focusing	VA-1512 Electromagnet

VA-1512 ELECTROMAGNET

Focusing Electromagnet for VA-816J

Power Requirement	1500 W
Dimensions	15 dia x 22½ in
Weight	475 lb
Cooling	Water

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PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

PULSE POWER KLYSTRONS

C-BAND PULSE AMPLIFIER

VA-808 Series

5.3 to 5.9 kMc
20 kw peak
300 W average

Tubes of the VA-808 Series are four-cavity high-gain pulse amplifier klystrons for fixed frequency, coherent radar service. Permanent magnet focusing, air cooling, and rugged construction make this unit a simple and reliable amplifier.

CHARACTERISTICS:

Frequency	5.3-5.9 kMc
Tuning Range	50 Mc
Power Output, Peak	20 kw
Power Output, Avg.	300 W
Gain (synchronously tuned)	65 db
Bandwidth (synchronously tuned)	13 Mc
Pulse Duration	4 μsec
Beam Voltage, Peak	22 kv
Beam Current, Peak	3.3 a
Dimensions	7⅜ x 12 x 15⅛ in
Weight	28 lb
Cooling	Forced Air
Focusing	Permanent Magnet

X-BAND PULSE AMPLIFIER

VA-845 Series

9.3 to 9.6 kMc
5 kw peak
500 W average

Tubes of the VA-845 Series are four-cavity high-gain pulse amplifier klystrons for coherent radar to operate under severe environmental conditions. These liquid cooled tubes have permanent magnets and extremely rugged structures designed to provide reliable service.

CHARACTERISTICS:

Frequency	9.3-9.6 kMc
Tuning Range	50 Mc
Power Output, Peak	5 kw
Power Output, Avg.	500 W
Gain (synchronously tuned)	55 db
Bandwidth (synchronously tuned)	16 Mc
Pulse Duration	5 μsec
Beam Voltage, Peak	14 kv
Beam Current, Peak	1.55 a
Dimensions	4¾ x 8 x 8¼ in
Weight	17 lb
Cooling	Liquid
Focusing	Permanent Magnet

X-BAND PULSE AMPLIFIER

V-24C Series

9.0 to 9.6 kMc
50 kw peak
250 W average

Tubes of the V-24C Series are four-cavity high-gain pulse amplifier klystrons for coherent radar service. Permanent magnet focusing and air cooling make a simple and easily operated amplifier unit.

CHARACTERISTICS:

Frequency	9.0-9.6 kMc
Tuning Range	100 Mc
Power Output, Peak (min.)	65 kW
Power Output, Avg.	150 W
Gain (synchronously tuned)	56 db
Bandwidth (synchronously tuned)	23 Mc
Pulse Duration	3 μsec
Beam Voltage, Peak	36 kv
Beam Current, Peak	6 a
Dimensions	6½ x 8¼ x 13 in
Weight	20 lb
Cooling	Forced Air
Focusing	Permanent Magnet

X-BAND PULSE AMPLIFIER

V-82B

9.31 kMc
5 kw peak
125 W average

The V-82B is a four-cavity high-gain pulse amplifier klystron for fixed frequency, coherent radar service. Permanent magnet focusing, air cooling, and temperature compensation make a simple reliable amplifier unit for use in widely varying ambient temperature conditions.

CHARACTERISTICS:

Frequency, Fixed Tuned	9.31 kMc
Power Output, Peak	7 kw
Power Output, Avg.	150 W
Gain	57 db
Bandwidth	15 Mc
Pulse Duration	1 μsec
Beam Voltage, Peak	17 kv
Beam Current, Peak	2.2 a
Dimensions	7⅝ x 8 x 12½ in
Weight	18 lb
Cooling	Forced Air
Focusing	Permanent Magnet

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

MAGNETRONS

ARRANGED BY FREQUENCY BANDS

DESIGNED FOR

- BEACON RADAR SYSTEMS
- GUIDED MISSILE TELEMETERING SYSTEMS
- HIGH RESOLUTION AIRBORNE MAPPING SYSTEMS
- WEATHER FORECASTING RADAR SYSTEMS
- BATTLEFIELD IDENTIFICATION RADAR SYSTEMS
- GROUND, MARINE, AND AIR DETECTION SYSTEMS
- AIRPORT SURVEILLANCE
- HIGH SPEED HYDRAULIC TUNED SYSTEMS

Bomac has built up an outstanding reputation for producing magnetrons of exceptional quality. Such necessary and desirable characteristics as long life, reliability, ruggedness and compactness have been bywords with our customers for many years. Experience gained since the early days of the Company has produced magnetrons which are used in nearly all types of applications.

Magnetrons described in this catalogue are designed to operate over the widest possible ranges of conditions. Maximum performance may only be expected when used with matching modulator and rf load. However, slight revisions to the magnetron, as recommended by the Applications Engineer, may be made which will optimize the performance in your existing equipment. For this service, we invite you to contact our Sales Department or Bomac Representatives.

PAGE 31 TO 35
PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

TYPE "M" BWO

BL-857

2.5 to 3.3 kMc

- *Tunable*
- *Electronically Tuned*

The BL-857 is a voltage-tunable S-band M-type BWO having a liquid-cooled integral magnet. It is electronically tunable and relatively insensitive to variations of load VSWR as high as 2:1. The tube may be modulated both in amplitude and frequency by the application of suitable voltages to the sole, grid or accelerator. The frequency is varied by adjustment of the anode-to-sole voltage.

CHARACTERISTICS:

Frequency	2.5-3.3 kMc
Power Output	180 W
Accelerator Voltage (max)	1300 V
Accelerator Current, Peak (max)	5 ma
Anode Voltage	2.5-5.0 kV
Anode Current	300 mA
Sole Voltage	850-1050 V
Sole Current, Peak (max)	25 ma

C-BAND MAGNETRON

7088/BL-212

5.4 to 5.9 kMc

- *Designed for Low Voltage Operation*

This rugged tunable magnetron for airborne or missile beacon use is very reliable and frequency stable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	5.4-5.9 kMc
Power Output, Peak (min)	100 w
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.15-1.45 kv
Anode Current, Peak	0.8 a

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MAGNETRONS

C-BAND MAGNETRON

BL-250

5.4 to 5.9 kMc

This rugged tunable magnetron for airborne or missile beacon use is very reliable and frequency stable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	5.4-5.9 kMc
Power Output, Peak (min)	150 w
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.15-1.45 kv
Anode Current, Peak	1 a

C-BAND MAGNETRON

BL-242

5.4 to 5.9 kMc

This rugged tunable magnetron for airborne or missile beacon use is very reliable and frequency stable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	5.4-5.9 kMc
Power Output, Peak (min)	400 w
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.7-2.1 kv
Anode Current, Peak	1.1 a

C-BAND MAGNETRON

BL-223A

5.4 to 5.9 kMc

- *Miniaturized*
- *Improved Compact Design*
- *Ruggedized*

This rugged tunable magnetron for airborne or missile beacon use is very reliable and frequency stable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	5.4-5.9 kMc
Power Output, Peak (min)	400 w
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.7-2.1 kv
Anode Current, Peak	1.1 a
Weight	6 oz

C-BAND MAGNETRONS

BLM-008

5.4 to 5.9 kMc

BLM-022

5.4 to 5.9 kMc

BLM-026

5.4 to 5.9 kMc

- *Miniaturized*
- *Tunable*

These three tubes are rugged, tunable, miniature C-band magnetrons used for beacon applications requiring a peak power output of about 500 watts. The three types are similar in construction, but each type is tested to meet different environmental conditions.

CHARACTERISTICS:

	BLM-008	BLM-022	BLM-026	
Frequency	5.4-5.9	5.4-5.9	5.4-5.9	kMc
Power Output, Peak (min)	400	500	500	w
Pulse Width (max)	1	1	1	μsec
Duty Cycle	0.002	0.002	0.002	
Anode Voltage, Peak	1.9-2.3	1.9-2.3	2.1-2.3	kv
Anode Current, Peak	1.1	1.1	1.1	a
Weight	7	7	7	oz

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MAGNETRONS

ARRANGED BY FREQUENCY BANDS

C-BAND MAGNETRONS

BLM-020
5.4 to 5.9 kMc

BL-245
5.4 to 5.9 kMc

BL-230
5.4 to 5.9 kMc

- *Wide Tuning Range*
- *Miniaturized*
- *High Efficiency*

These rugged tunable magnetrons for airborne or missile beacon use are very reliable and frequency stable under severe environmental conditions. Compact miniaturized tubes, they are designed for rapid installation. They have integral permanent magnets and are cooled by conduction or forced air.

CHARACTERISTICS:

	BLM-020	BL-245	BL-230	
Frequency	5.4-5.9	5.4-5.9	5.4-5.9	kMc
Power Output, Peak (min)	700	900	1000	w
Pulse Width (max)	1.0	1.0	1.0	μsec
Duty Cycle	0.002	0.002	0.002	
Anode Voltage, Peak	2.3-2.6	2.4-2.7	2.35-2.75	kv
Anode Current, Peak	1.4	1.5	1.7	a
Weight	10	10	10	oz

C-BAND MAGNETRON

BL-244
5.5 to 5.6 kMc

- *Fixed Frequency*
- *High Shock Resistance*

The BL-244 is a medium power fixed frequency magnetron recommended for surface radar applications. It is forced-air cooled, and has an integral permanent magnet.

CHARACTERISTICS:

Frequency	5.5-5.6 kMc
Power Output, Peak (min)	10 kw
Pulse Width (max)	1 μsec
Duty Cycle	0.0003
Anode Voltage, Peak	7-8 kv
Anode Current, Peak	4 a

X-BAND MAGNETRON

7503/BLM-024
9.3 to 9.5 kMc

- *Tunable*
- *Compact*

This rugged tunable magnetron for airborne or missile beacon use is very reliable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	9.3-9.5 kMc
Power Output, Peak (min)	100 w
Pulse Width (max)	1.5 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.35-1.55 kv
Anode Current, Peak	0.95 a
Dimensions	1¼ dia x 2½ in
Weight	6 oz

X-BAND MAGNETRONS

BLM-003
9.0 to 9.5 kMc

BLM-014
8.5 to 9.0 kMc

- *Wide Tunable Range*
- *High Reliability*
- *Miniaturized*

These rugged tunable magnetrons for airborne or missile beacon use are very reliable and frequency stable under severe environmental conditions. Compact miniaturized tubes, they are designed for rapid installation. They have integral permanent magnets and are cooled by conduction or forced air.

CHARACTERISTICS:

	BLM-003	BLM-014	
Frequency	9.0-9.5	8.5-9.0	kMc
Power Output, Peak (min)	150	150	w
Pulse Width (max)	1	1	μsec
Duty Cycle	0.002	0.002	
Anode Voltage, Peak	1.1-1.35	1.1-1.35	kv
Anode Current, Peak	0.90	0.90	a
Weight	7	7	oz

The Above Products Are Manufactured by Bomac Laboratories . . . . . Beverly, Massachusetts

PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

MAGNETRONS

X-BAND MAGNETRON

BLM-044

9.3 to 9.5 kMc

This tube, recommended for airborne and missile beacon applications, has a precision gear tuner and very low heater current. It is reliable and frequency stable under severe environmental conditions. A miniature and compact unit, it is forced air or conduction cooled. It is similar to the BLM-024.

CHARACTERISTICS:

Frequency	9.3-9.5 kMc
Power Output, Peak (min)	150 w
Pulse Width (max)	1.5 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.05-1.35 kv
Anode Current, Peak	0.95 a
Weight	6 oz

X-BAND MAGNETRON

BLM-015

9.0 to 9.5 kMc

- *Wide Tuning Range*
- *Miniaturized*
- *High Efficiency*

This rugged tunable magnetron, recommended for airborne and missile beacon use, is capable of high reliability and frequency stability under severe environmental conditions. The tube has an integral permanent magnet and is conduction or forced-air cooled. It is miniaturized and designed for easy installation.

CHARACTERISTICS:

Frequency	9.0-9.5 kMc
Power Output, Peak (min)	350 w
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	1.35-1.55 kv
Anode Current, Peak	1.0 a

X-BAND MAGNETRON

7446/BL-233

9.345 to 9.405 kMc

This fixed frequency X-band light weight magnetron is recommended for portable or marine radar use. The design features low cost construction and low power consumption. The tube has an integral permanent magnet and is conduction or forced-air cooled.

CHARACTERISTICS:

Frequency	9.345-9.405 kMc
Power Output, Peak (min)	800 w
Pulse Width (max)	1 μsec
Duty Cycle	0.0015
Anode Voltage, Peak	2.7-2.9 kv
Anode Current, Peak	1.5 a

X-BAND MAGNETRON

BLM-012

8.9 to 9.4 kMc

- *Miniaturized*
- *High Efficiency*
- *High Power Beacon Tube*

This rugged tunable magnetron for airborne or missile beacon use is very reliable and frequency stable under severe environmental conditions. A compact miniaturized tube, it is designed for rapid installation. It has an integral permanent magnet and is cooled by conduction or forced air.

CHARACTERISTICS:

Frequency	8.9-9.4 kMc
Power Output, Peak (min)	1 kw
Pulse Width (max)	1 μsec
Duty Cycle	0.002
Anode Voltage, Peak	2.3-2.6 kv
Anode Current, Peak	1.9 a
Weight	15 oz

X-BAND MAGNETRON

5780

8.5 to 9.6 kMc

- *Tunable*
- *Wide Tuning Range*
- *Rugged Construction*
- *Built-in Arc Quencher*

This tunable, pulse type magnetron will withstand high shock, up to 50 G. It is a rugged tube with integral permanent magnet construction and forced air cooling. The external mechanical tuner is designed for remote operation. An arc quencher, built into the output waveguide, minimizes window burnout.

CHARACTERISTICS:

Frequency	8.5-9.6 kMc
Power Output, Peak (min)	250 kw
Pulse Width (max)	0.30 μsec
Duty Cycle	0.00033
Anode Voltage, Peak	32-34 kv
Anode Current, Peak	30 a

Ku-BAND MAGNETRON

BLM-027

16.0 to 16.4 kMc

- *Light Weight*
- *Tunable*

This pulse type, air-cooled, tunable magnetron is recommended for high definition radar. It is light weight and has an integral permanent magnet. The external tuner may be adapted for remote operation.

CHARACTERISTICS:

Frequency	16.0-16.4 kMc
Power Output, Peak (min)	500 w
Pulse Width	0.5 μsec
Duty Cycle	0.003
Anode Voltage, Peak	3.4-3.8 kv
Anode Current, Peak	1 a
Weight	20 oz

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MAGNETRONS

ARRANGED BY FREQUENCY BANDS

Ku-BAND MAGNETRON

BLM-071

15.9 to 16.1 kMc

- *High Power-to-Weight Ratio*

The BLM-071 is a fixed-frequency, Ku-band magnetron capable of 100-kw peak power output at a maximum duty cycle of 0.001. Internal construction and the use of ceramic parts permit operation at relatively high ambient temperatures. Input and output terminals can be pressurized up to 30 PSIA.

CHARACTERISTICS:

Frequency	15.9-16.1 kMc
Power Output, Peak (min)	100 kw
Pulse Width	0.07-1.00 μsec
Duty Cycle (max)	0.001
Anode Voltage, Peak	19.0-22.0 kv
Anode Current, Peak	20 a
Weight	8 lb

K-BAND MAGNETRONS

6551

23.80 to 24.27 kMc

BLM-006

23.80 to 24.27 kMc

- *Fixed Frequency*
- *Metal-Ceramic Construction*

These tubes are medium power K-band magnetrons capable of operating over a wide range of pulse conditions. The BLM-006 characteristics are particularly applicable to short range, high resolution systems.

CHARACTERISTICS:

	6551	BLM-006	
Frequency	23.80-24.27	23.80-24.27	kMc
Power Output, Peak (min)	40	40	kw
Pulse Width	0.5	0.03	μsec
Duty Cycle	0.0006	0.0003	
Anode Voltage, Peak	13-15	13-14.5	kv
Anode Current, Peak	15	15	a

V-BAND MAGNETRONS

BL-221

69.0 to 70.5 kMc

BL-246

68.0 to 71.5 kMc

- *Fixed Tuned*
- *Metal-Ceramic Construction*

These two fixed-tuned 4.3-mm magnetrons will operate under adverse environmental conditions. Superior performance results from using high-strength ceramic structures and by minimizing weight. Weight reductions have been achieved from a new cathode structure and new magnet geometry using higher permeability material. Both input and output may be pressurized. The pressure seal and choke used in this tube are more rugged mechanically and more uniform electrically than usual flanges for this band.

CHARACTERISTICS:

	BL-221	BL-246	
Frequency	69.0-70.5	68.0-71.5	kMc
Power Output, Peak (min)	10	8	kw
Pulse Width (max)	0.33	0.25	μsec
Duty Cycle	0.0005	0.0005	
Anode Voltage, Peak	12.0-13.5	12.0-15.0	kv
Anode Current, Peak	9	9	a
Dimensions	4x6x6½	4x6x6½	in
Weight	7.25	7.25	lb

V-BAND MAGNETRONS

BL-235

51.0 to 54.0 kMc

BL-236

54.0 to 57.0 kMc

BL-237

57.0 to 60.0 kMc

These 5-mm magnetrons are capable of 10-kw peak power output at 0.0007 duty cycle. Good performance under adverse environment is obtained by use of ceramic parts, weight reduction and improved magnetic circuitry. This light weight tube can be operated at high altitudes with pressurized input and output.

CHARACTERISTICS:

	BL-235	BL-236	BL-237	
Frequency	51.0-54.0	54.0-57.0	57.0-60.0	kMc
Power Output, Peak (min)	10.0	10.0	10.0	kw
Pulse Width (max)	0.4	0.4	0.4	μsec
Duty Cycle	6-8	6-8	6-8	x 10^{-4}
Anode Voltage, Peak	12.5-14.5	12.5-14.5	12.5-14.5	kv
Anode Current, Peak	8	8	8	a

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PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

BACKWARD

VARIAN BACKWARD WAVE OSCILLATOR TUBES

Varian backward wave oscillator tubes have been designed in accordance with the same basic principles that have been so successful in the production of rugged, high performance klystron tubes.

Designed for low voltage operation, these dependable tubes make compact system packaging possible and simplify power supply design problems, since heavy and expensive high voltage power supplies are not required.

The use of all-metal-ceramic construction makes these BWO tubes an ideal choice for airborne systems where ruggedness and reliability are essential. Waveguide, helix and magnet are normally operated at ground potential and the tubes may be operated at any altitude without pressurization.

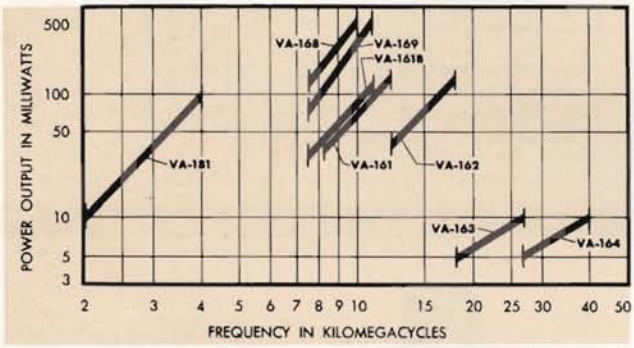
Each BWO design is carefully optimized for performance in the specified operating range.

New methods of precision fabrication and careful control of assembly techniques yield tubes that are remarkably free of fine line structure variation in the output level-frequency characteristic curve. Also of significance are the extremely small departures of the frequency-voltage characteristics from theoretical curves.

BWO's are available with the waveguide and the helix isolated. This feature permits operation with the cathode at ground potential thus reducing heater power supply insulation requirements and lowering the shunt capacitance seen by the modulator. When operating with the cathode at ground potential, pressurization is required for high altitude applications.

Varian Associates welcomes inquiries for development of tubes for new or existing applications. Frequently, existing product designs can be readily modified to give characteristics which meet the requirements of a specific application. Tubes at other power levels and operating frequencies are continually being developed to meet the demands of the rapidly expanding microwave field.

BWO POWER—FREQUENCY CHART



S-BAND BWO

VA-181

2.0 to 4.0 kMc

New

- *Metal and Ceramic Construction*
- *Weight 15 Oz.*

The VA-181 is a rugged, electrostatically focused backward wave oscillator for local oscillator, signal generator, missile and satellite applications. It is particularly well suited for applications where extremely severe environments are encountered. The small size and light weight simplify the design of compact systems. Balanced dual output is provided by means of two coaxial connectors.

CHARACTERISTICS:

Frequency	2.0 to 4.0 kMc
Power Output, min.	10 mW
Tuning Voltage	200 to 2000 Vdc
Focusing Voltage	100 to 400 Vdc
Cathode Current	40 mAdc
Grid Voltage	40 Vdc
Size, exclusive of connector	1¼" dia x 7" long

X-BAND BWO

VA-169

7.5 to 11.0 kMc

The VA-169 is a higher power version of the VA-161 but operates within a slightly different frequency range. The helix and output waveguide are isolated from each other and from the tube magnet. Otherwise, the tube is physically identical to the VA-161.

CHARACTERISTICS:

Frequency	7.5 Min.	7.5 Avg.	11.0 Min.	11.0 Avg.	kMc
Power Output	50	75	50	400	mW
Helix Voltage	—	250	—	860	Vdc
Helix Current	—	30	—	34	mAdc
Grid Voltage	—	80	—	80	Vdc
Helix Modulation Sensitivity	8	11.2	2	3.4	Mc/V

X-BAND BWO

VA-161B

7.5 to 11.0 kMc

The VA-161B is a lower frequency version of the VA-161. It is physically identical to the VA-161 and includes all of the same features.

CHARACTERISTICS:

Frequency	7.5 Min.	7.5 Avg.	11.0 Min.	11.0 Avg.	kMc
Power Output	10	30	20	110	mW
Helix Voltage	—	150	—	450	Vdc
Helix Current	—	20	—	22	mAdc
Grid Voltage	—	40	—	40	Vdc
Helix Modulation Sensitivity	13	19	3	7	Mc/V

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WAVE OSCILLATORS

X-BAND BWO

VA-168

7.5 to 10.0 kMc

The VA-168 is a higher power version of the VA-161 for frequency diversity radar applications. It operates within a slightly different frequency range. The helix and output waveguide are isolated from each other and from the tube magnet. Otherwise, the tube is physically identical to the VA-161.

CHARACTERISTICS:

Frequency	7.5 Min.	7.5 Avg.	10.0 Min.	10.0 Avg.	kMc
Power Output	100	125	100	400	mW
Helix Voltage	—	290	—	760	Vdc
Helix Current	—	35	—	39	mAdc
Grid Voltage	—	80	—	80	Vdc
Helix Modulation Sensitivity	6	9	2	3.5	Mc/V

X-BAND BWO

VA-161

8.2 to 12.4 kMc

- *Metal and Ceramic Construction*
- *Voltage Tunable*
- *Smooth Power Output*
- *Low Operating Voltages*
- *Small Size*
- *Convection Cooled*

The VA-161 is a rugged, compact, permanent magnet focused, voltage tunable backward wave oscillator for radar local oscillator, signal generator and panoramic receiver applications. The voltage tunable feature along with the very small fine grain structure of the power output vs. frequency characteristics make the VA-161 ideal for high speed, wide frequency range, swept signal sources. Its small size and low voltage supply requirements are especially desirable in compact airborne systems.

CHARACTERISTICS:

Frequency	8.2 Min.	8.2 Avg.	12.4 Min.	12.4 Avg.	kMc
Power Output	20	40	20	140	mW
Helix Voltage	—	157	—	550	Vdc
Helix Current	—	20	—	22	mAdc
Grid Voltage	—	45	—	45	Vdc
Helix Modulation Sensitivity	13	18	3	6	Mc/V

This tube is also manufactured by Varian Associates of Canada, Ltd.

Ku-BAND BWO

VA-162

12.4 to 18.0 kMc

The VA-162 is similar to the VA-161 backward wave oscillator. It operates at frequencies in the Ku-band and is physically identical except for the output waveguide and flange. The output flange mates with the UG-419/U.

CHARACTERISTICS:

Frequency	12.4 Min.	12.4 Avg.	18.0 Min.	18.0 Avg.	kMc
Power Output	10	40	10	140	mW
Helix Voltage	—	270	—	875	Vdc
Helix Current	—	13	—	14	mAdc
Grid Voltage	—	60	—	60	Vdc
Helix Modulation Sensitivity	10	14.5	3	5.5	Mc/V

K-BAND BWO

New

VA-163

18 to 27 kMc

- *Metal and Ceramic Construction*

The VA-163, operating in Ku-band, is a higher frequency version of the VA-161. Physically it differs only in the output waveguide and flange. The output flange mates with the UG-595/U.

CHARACTERISTICS:

Frequency	18 Min.	18 Avg.	27 Min.	27 Avg.	kMc
Power Output	5	8	5	8	mW
Helix Voltage	—	275	—	1100	Vdc
Helix Current	—	10	—	10	mAdc
Grid Voltage	—	150	—	150	Vdc
Grid Current	—	3	—	3	mAdc

K-BAND BWO

New

VA-164

27 to 40 kMc

- *Metal and Ceramic Construction*

The VA-164, operating in K-band, is a higher frequency version of the VA-161. Physically it differs only in the output waveguide and flange. The output flange mates with the UG-599/U.

CHARACTERISTICS:

Frequency	27 Min.	27 Avg.	40 Min.	40 Avg.	kMc
Power Output	3	5	3	5	mW
Helix Voltage	—	275	—	1100	Vdc
Helix Current	—	12	—	12	mAdc
Grid Voltage	—	80	—	80	Vdc
Grid Current	—	5	—	5	mAdc

Also available on special order with output to mate with round UG-381/U flange.

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PAGE 36 TO 39
PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

TRAVELING

WIDEBAND • HIGH GAIN • HIGH EFFICIENCY

Varian traveling wave amplifier tubes are wideband, high gain tubes with carefully designed and controlled characteristics. They are simple to install and operate. Electrostatic and periodic permanent magnet focusing are used frequently to provide light weight units. Tubes can be furnished with close phase tolerances for multi-tube phased arrays.

Varian is established as the leader in the field of medium power pulsed TWT's, and is the only established supplier of multi-megawatt traveling wave amplifiers. Many new traveling wave tubes are in development and design; Varian welcomes your inquiry about new products and product performance.

UHF PULSE AMPLIFIER

New

VA-134

0.490 to 0.610 kMc
5 kw peak
300 W average

The VA-134 is a grid-pulsed high gain tube which can be used as a final amplifier in multi-output-tube radars or as a driver for megawatt amplifiers of frequency-agile coherent radar systems. The tube has a periodic permanent magnet for focusing and is liquid cooled.

CHARACTERISTICS:

Bandwidth	120 Mc
Frequency Coverage	0.490-0.610 kMc
Power Output, peak	5 kw
Power Output, avg.	300 W
Gain	45 db
Pulse Duration	500 μsec
Beam Voltage, peak	10 kv
Beam Current, peak	2.5 a
Grid Voltage	
Bias	−300 Vdc
Peak (above cathode)	450 v
Dimensions	7 dia x 70¼ in.
Weight	100 lb
Cooling	Liquid
Focusing	Periodic Permanent Magnet

L-BAND PULSE AMPLIFIER

VA-131

1.15 to 1.55 kMc
50 kw peak
200 W average

The VA-131 is a grid-pulsed high gain tube for use in airborne systems. It may be used as an element driver in phased-array radars or as a driver for megawatt amplifiers of frequency-agile coherent radar systems. The tube has periodic permanent magnet focusing and is liquid cooled.

CHARACTERISTICS:

Bandwidth	400 Mc
Frequency Coverage	1.15-1.55 kMc
Power Output, peak	50 kw
Power Output, avg.	200 W
Gain	45 db
Pulse Duration	25 μsec
Beam Voltage	25 kVdc
Beam Current, peak	8 a
Grid Voltage	
Bias	−300 Vdc
Peak (above cathode)	400 v
Dimensions	5⅛ x 6½ x 56 in.
Weight	90 lb
Cooling	Liquid
Focusing	Periodic Permanent Magnet

UHF CW AMPLIFIER

VA-132

0.5 to 1.0 kMc
200 W CW

The VA-132 air-cooled CW amplifier tube is used for broadband applications where small size, light weight and ruggedness are important. An air-cooled electromagnet provides a self-centering tube mount.

CHARACTERISTICS:

Bandwidth	500 Mc
Frequency Coverage	0.500-1.000 kMc
Power Output	200 W
Gain	30 db
Beam Voltage	2.1 kVdc
Beam Current	0.7 Adc
Dimensions (with solenoid)	4 x 6 x 23 in.
Weight	45 lb
Cooling	Forced Air
Focusing	VA-1532 Electromagnet

VA-1532 ELECTROMAGNET

Focusing Electromagnet for VA-132

Power Requirement	250 W
Dimensions	3½ dia x 20⅛ in.
Weight	28 lb
Cooling	Forced Air

L-BAND PULSE AMPLIFIER

New

VA-133

1.25 to 1.40 kMc
5 kw peak
330 W average

The VA-133 is a grid-pulsed high gain tube which can be used as an element driver in phased-array radars or as a driver for megawatt amplifiers of frequency-agile coherent radar systems. Deviations from phase linearity are kept to a minimum. Gain over 10 percent bandwidth is held to within ±0.25 db. The tube has periodic permanent magnet focusing and is liquid cooled.

CHARACTERISTICS:

Bandwidth	150 Mc
Frequency Coverage	1.25-1.40 kMc
Power Output, peak	5 kw
Power Output, avg.	330 W
Gain	50 db
Pulse Duration	500 μsec
Beam Voltage, peak	11.5 kVdc
Beam Current, peak	2.2 a
Grid Voltage	
Bias	−200 Vdc
Peak (above cathode)	200 v
Dimensions	3 dia x 48 in.
Weight	50 lb
Cooling	Liquid
Focusing	Periodic Permanent Magnet

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WAVE AMPLIFIERS

RELIABLE • PROVED STRUCTURES • WIDE CHOICE OF CHARACTERISTICS

Bandwidth figures stated for TWTs are synonymous with frequency coverage. Representative values are 10 to 65 percent; they vary according to the application.

L-BAND CW AMPLIFIER

VA-601

1.0 to 2.0 kMc
50 W CW

New

- *Metal and Ceramic Construction*
- *PPM Focused*

The VA-601 is a periodic permanent magnet focused traveling wave amplifier which provides a minimum CW power output of 50 watts in L-band. It is forced air cooled. Input and output rf connectors are Type C coaxial.

CHARACTERISTICS:

Frequency	1 to 2 kMc
Power Output, min.	50 W
Beam Voltage	2000 Vdc
Beam Current	225 mAdc
Saturated Gain, min.	40 db

S-BAND PULSE AMPLIFIERS

VA-125A

VA-125A

2.60 to 2.95 kMc

VA-125B

2.90 to 3.25 kMc
2 Mw peak
4 kW average

The VA-125A and VA-125B are traveling wave pulse amplifier tubes for coherent and frequency-agile phased-array radar systems. Simple rugged construction with self-centering non-critical mounting in the electromagnet provides a reliable amplifier unit which requires no adjustments.

CHARACTERISTICS:

Bandwidth	350 Mc
Frequency Coverage	
VA-125A	2.60-2.95 kMc
VA-125B	2.90-3.25 kMc
Power Output, peak	3.0 Mw
Power Output, avg.	4.0 kW
Gain	35 db
Pulse Duration	10 μsec
Beam Voltage, peak	120 kv
Beam Current, peak	75 a
Dimensions	
VA-125A	10 x 17 x 43½ in.
VA-125B	10 x 15¾ x 42 in.
Weight	120 lb
Cooling	Liquid
Focusing	VA-1525 Electromagnet

VA-1525 ELECTROMAGNET

Focusing Electromagnet for VA-125A and VA-125B

Power Requirement	2400 W
Cooling	Water
Dimensions	16⅞ dia x 26⅞ in.
Weight	475 lb

S-BAND PULSE AMPLIFIER

VA-128

2.7 to 3.5 kMc
5 kw peak
15 W average

The VA-128 is a traveling wave pulse amplifier tube for advanced coherent and frequency-agile radar systems requiring rigid control of tube characteristics. It is air cooled and light weight with periodic permanent magnet focusing. Its characteristics are suited to use in multi-tube final amplifier units or to service in the driver stages of multi-megawatt TWT amplifiers (such as the VA-125A,B).

CHARACTERISTICS:

Bandwidth	800 Mc
Frequency Coverage	2.7-3.5 kMc
Power Output, peak	5 kw
Power Output, avg.	15 W
Gain	34 db
Pulse Duration	10 μsec
Beam Voltage	14.5 kVdc
Beam Current, peak	3.7 a
Grid Voltage	
Bias	−150 Vdc
Peak (above cathode)	700 v
Dimensions	3⅝ x 4⅛ x 19¾ in.
Weight	12½ lb
Cooling	Forced Air
Focusing	Periodic Permanent Magnet

X-BAND PULSE AMPLIFIER

VA-126

New

5.4 to 5.9 kMc
3 Mw peak
5.0 kW average

The VA-126 pulse amplifier is used in advanced frequency-agile coherent radar systems. This liquid-cooled tube is self-centering in its electromagnet which simplifies installation. Typical efficiency is 30 percent.

CHARACTERISTICS:

Bandwidth	500 Mc
Frequency Coverage	5.4-5.9 kMc
Power Output, peak	3.3 Mw
Power Output, avg.	5.0 kW
Gain	35 db
Pulse Duration	10 μsec
Beam Voltage, peak	125 kv
Beam Current, peak	95 a
Dimensions	16 x 16 x 33 in.
Weight	75 lb
Cooling	Liquid
Focusing	VA-1526 Electromagnet

VA-1526 ELECTROMAGNET

Focusing Electromagnet for VA-126

Power Requirement	3000 W
Dimensions	14⅜ dia x 15¾ in.
Weight	250 lb
Cooling	Liquid

PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

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STABILIZATION

FREQUENCY-STABILIZED LOW-NOISE

FEATURING

- *Unlimited life*
- *Light weight*
- *Long term stability to 1 part in 10^5*
- *Short term stability to 1 part in 10^9*
- *Compensated against thermal drift up to 5 parts in 10^7 per °C.*

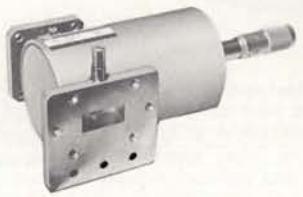
Passive cavity stabilization of reflex klystrons produces efficient, reliable frequency stabilization without the frequency response limitation of conventional electronic AFC circuitry. The degree of stabilization is independent of the frequency of the disturbance.

A figure of merit for these cavity stabilized systems is the stabilization factor. For example, a factor of 25 means that a reflector modulation sensitivity of 1 Mc/volt for an unstabilized klystron is effectively reduced by 1/25th, or to 40 kc/volt. The same reduction is applicable to the other frequency-dependent parameters of the tube, including frequency pulling due to load variations.

Write for Application Engineering Bulletin No. 14 for detailed information on the Passive Stabilization technique.

Cavities can be provided for stabilization of any klystron oscillator listed in this catalog. Special cavities can be designed for custom applications.

VA-1262



6½" long x 3" wide x 2½" high

- *Tunable ±125 Mc in X-Band*
- *Stabilization Factor = 30 Approximately*
- *Unloaded Q = 30,000*

The VA-1262 stabilizing cavity is easily and accurately tunable and provides a stabilization factor of approximately 30. The insertion loss is adjustable from 6 to 12 db. This cavity is especially suited for uses where a tunable highly stable source of microwave energy is needed. For a ruggedized version, see the VA-1296.

VA-1261

- *Available at Any Frequency in X-Band. Trimmable ±20 Mc*
- *Unloaded Q = 38,000*
- *Stabilization Factor = 30 Approximately*
- *Temperature Compensated*

3⅜" long x 3-11/16" wide x 2½" high

The VA-1261 is temperature compensated to 5 parts in 10^7/°C. Rigid brazed and welded construction insures stable nonmicrophonic operation. This cavity is intended for fixed frequency application but it does have a trim frequency tuning adjustment as indicated above. Cavity insertion loss is normally 10 db. The insertion loss can be decreased with a resultant slight decrease in stabilization factor.

VA-1280B

23" high—mounts on three supports, with 5½" radius

- *Tunable 8.2 to 10.2 kMc*
- *Stabilization Factor With VA-201B Klystron = 120*
- *Unloaded Q = 110,000*

The VA-1280B stalo cavity provides a very high degree of short term frequency stability for airborne and similar systems. This cavity has a short term frequency stability to 1 part in 10^9 and wide range tunability making it a very useful laboratory instrument. Reduction in oscillator power through the cavity is 10 db with a small range of adjustment. When used to stabilize the VA-201B klystron, the stabilized power output is ample to supply a local oscillator signal or to drive a klystron amplifier.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

CAVITIES

MICROWAVE POWER FOR...

- Elimination of active AFC loops in microwave receivers
- Stable master oscillators in doppler transmitters
- Reliable beacons
- Low noise test application

VA-1281
±50 Mc

VA-1281E*
±50 Mc

- *Available at Any Frequency in X-Band*
- *Stabilization Factor = 20 Approximately*
- *Unloaded Q = 20,000*
- *Light Weight*

VA-1281E*

3⅜" long x 2⅜" wide x 2⅜" high

These two cavities are similar; however, the VA-1281 is temperature compensated to 1 part in 10^6 while the VA-1281E is compensated to 5 parts in 10^7 and has convenient mounting tabs attached to the input and output flanges. Rigid welded and brazed construction is used throughout, yielding excellent resistance to microphonics. The cavities are intended for fixed frequency application but have a tuning adjustment range as indicated above. The insertion loss through the cavities is normally 10 db, but can be reduced with a slight decrease in the stabilization factor. The weight of each of the cavities is approximately 20 ounces.

** The VA-1281E supersedes the VA-1281B and incorporates an improved mechanical design.*

VA-1281C

- *Band-Pass Filter Cavity*
- *Available at Any Frequency in X-Band*
- *Unloaded Q = 20,000*
- *Temperature Compensated*
- *Light Weight*

3⅜" long x 2⅜" wide x 2⅜" high

This cavity is mechanically similar to the VA-1281. It is, however, a band-pass filter, adjusted to have the highest possible Q for a given insertion loss. The insertion loss is normally set at 10 db. The half power bandwidth of this cavity is approximately 750 kc at 9350 Mc. The VA-1281C is temperature compensated to 1 part in 10^6 per °C.

VA-1282
±10 Mc

- *Available at Any Frequency in C-Band*
- *Stabilization Factor = 50*
- *Unloaded Q = 50,000*

VA-1284
±100 Mc

- *Available at Any Frequency in C-Band*
- *Stabilization Factor = 25*
- *Unloaded Q = 30,000*

VA-1284

7" long x 3⅝" wide x 3⅜" high
Shown with VA-220 F klystron

Designed for use in stabilizing the signal source in high-power klystron transmitters or in stabilizing receiver local oscillators. Ideally suited for airborne application. Cavity insertion loss is approximately 10 db for the VA-1282 and approximately 6 db for the VA-1284. The insertion loss can be reduced with a slight reduction in stabilization factor.

VA-1285
13.5 kMc ±50 Mc

- *Temperature Compensated*
- *Stabilization Factor With VA-92C Klystron = 20*
- *Unloaded Q = 35,000*
- *Trim Tuning Adjustment*

3-9/16" long x 3½" wide x 2-3/16" high
Shown with VA-92C klystron

This cavity provides a frequency stabilized source of microwave power at Ku-band. The VA-1285 uses welded and brazed construction and, like other Varian stabilizing cavities, is exceptionally low in microphonics. Temperature coefficient is 1 part in 10^6 per °C. The insertion loss of this cavity is set at 6 db. When used with the VA-92C klystron approximately 50 mW of power is available. Other frequencies in Ku-band are available on special order.

VA-1296

- *Tunable ± 125 Mc in X-Band*
- *Stabilization Factor = 20 Approximately*
- *Unloaded Q = 25,000*
- *Hermetically Sealed*

6½" long x 3½" wide x 3" high

The VA-1296 stalo cavity is typical of Varian Associates' ability to provide specialized cavities for individual needs. This cavity is hermetically sealed, readily tunable, and has high resistance to shock and vibration. It provides a stabilization factor of approximately 20 depending upon the oscillator used. The insertion loss is adjustable from 5 to 8 db.

VA-1299
±15 Mc

- *For Any Frequency in X-Band*
- *Stabilization Factor with VA-217C Klystron = 20*
- *Hermetically Sealed and Evacuated*
- *Temperature Compensated*

3⅜" long x 2⅜" wide x 2⅜" high
Shown with VA-217C klystron

The VA-1299 is the basic model of Varian Associates X-band series of hermetically sealed and evacuated high Q cavity resonators. These cavities provide frequency stabilization of microwave oscillators under conditions of variable pressure as well as variable temperature. Rigid brazed and welded construction is used throughout. Convenient tabs assure firm mounting into the waveguide system. A trim tuning adjustment is provided. All adjustments are secured with locknuts for stable non-microphonic operation. With the combination of a VA-1299 cavity and a VA-217C klystron, a long term stability of ±1 Mc under widely varying environmental conditions can be obtained with a well-regulated power supply. The VA-1299 has many applications when used as a frequency stabilizing device with reflex klystron oscillators such as the Varian VA-217C. Among these are uses in klystron transmitters, airborne receivers, local oscillators, and missile guidance systems.

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PAGE 40 TO 57
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

REFERENCE

Bomac reference cavities are available in a number of types for a wide variety of applications such as use for secondary frequency standards in radar or beacon receivers.

Both transmission and dual-mode cavities may be furnished as fixed-tuned, multi-channel fixed-tuned (detent), or continuously tuned (calibrated) types. The transmission type finds application in phase-shift-comparator systems. The dual-mode cavities, having two outputs tuned to slightly different frequencies, permit control by use of output voltages from separate crystal detectors. Their use requires less sophisticated circuitry and, at the same time, permits larger frequency ranges.

Representative stock items are listed below; special items are available upon request.

	PRODUCT NUMBER	FREQUENCY RANGE Mc	QL	IL db	FEATURE
C BAND	BL-467	5400-5900	1400	13 max. cavity only	Direct reading tunable dual mode cavity with input transition and attenuator, output attenuators and crystal detectors, calibrated in 0.5 Mc increments
	BL-476	5400-5900	1400	13 max.	Same as above, but without input transition, attenuator or output crystal detectors
X BAND	1Q22	9250	1900-2400	4-6	Transmission, copper body, aluminum mounting block temperature coefficient .015 Mc/°C.
	1Q23	9280	1900-2400	4-6	
	1Q24	9310	1900-2400	4-6	
	5846	9280	2100	4-6	
	6040	9308	2100	4-6	
	6041	9312	2100	4-6	

The 1Q series shown above may be made to order in the frequency range of 9230 to 9330 and with a maximum QL of 3000 and a corresponding min. IL of 10 db. With relaxed temperature coefficient the frequency range may be expanded to cover 9000 to 10,000 mc.

MICROWAVE

	FORWARD POLARITY [1]	REVERSE POLARITY [2]	MATCHED PAIRS [3] FORWARD	MATCHED PAIRS [3] FORWARD & REVERSE [4]	REVERSIBLE POLARITY [5]	TEST FREQUENCY Mc	MAX. CONVERSION LOSS db	MAX. OUTPUT NOISE RATIO
S BAND	1N21B	1N21BR	1N21BM	1N21BMR	1N416B	3060	6.5	2.0
	1N21C	1N21CR	1N21CM	1N21CMR	1N416C	3060	5.5	1.5
	1N21D	1N21DR	1N21DM	1N21DMR	1N416D	3060	5.0	1.3
	1N21E	1N21ER	1N21EM	1N21EMR	1N416E	3060	—	—
	1N21WE [8]	1N21WER	1N21WEM	1N21WEMR	1N21WE	3060	5.5	1.5
	BL179	BL179R	BL179M	BL179MR	—	3060	—	—
	1N21F	1N21FR	1N21FM	1N21FMR	—	3060	—	—
X BAND	1N23B	1N23BR	1N23BM	1N23BMR	1N415B	9375	6.5	2.7
	1N23C	1N23CR	1N23CM	1N23CMR	1N416C	9375	6.0	2.0
	1N23D	1N23DR	1N23DM	1N23DMR	1N416D	9375	5.0	1.7
	1N23E	1N23ER	1N23EM	1N23EMR	1N416E	9375	—	—
	1N23WE [8]	1N23WER	1N23WEM	1N23WEMR	1N23WE	9375	6.0	1.4
	1N149	1N149R	1N149M	1N149MR	1N149	9375	5.5	1.5
	BL173	BL173R	BL173M	BL173MR	BL173	9375	5.5	1.4
	BL169 [9]	BL169R	BL169M	BL169MR	BL169	—	6.0	2.0
	BL172	BL172R	BL172M	BL172MR	—	9375	6.0	1.4
	BL172A	BL172AR	BL172AM	BL172AMR	—	9375	6.0	1.4

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CAVITIES

ARRANGED BY FREQUENCY BANDS

1Q23

	PRODUCT NUMBER	FREQUENCY RANGE Mc	QL	IL db	FEATURE
X BAND	1Q26A	9280	1000-1500	4-8	Small invar transmission cavity with temperature coefficient of .006 Mc/°C.
	6301	9270	1000-1500	5-8	Small invar transmission cavity with temperature coefficient of .006 Mc/°C.
	6452	9350	1500-2000	4-8	Small invar transmission cavity with temperature coefficient of .006 Mc/°C.
	BL-468	* X-band	1950 nominal	5-8	Transmission cavity six positions detent, fixed tuned up to 25 Mc separation. Temperature coefficient .009 Mc/°C.
	BL-469	* X-band	1200-2500	7-13	Dual mode six-position detent, fixed tuned up to 100 Mc separation. Temperature coefficient .005 Mc/°C.
	BL-470	* X-band	2000-2500	6 max.	Reference cavity fixed tuned. VSWR 1.4 max. temperature coefficient .0038 Mc/°C. Controlled input and output reference plane location
	BL-471	* X-band	90,000 (approx.)	"Echo-Box"	Dual frequency fixed tuned ring time in excess of 20 μsec. Difference in ring time between frequencies less than 3 μsec.
	BL-472	* X-band	1000-1400	8-10	"Plug-in" transmission cavity for quick change of frequency over an 8500 to 9600 Mc range, temperature coefficient .006 Mc/°C.
	BL-459	8800	1200-1800	8 max.	Transmission cavity, fixed tuned, light-weight model temperature coefficient, .007 Mc/°C.
	BL-435	9280-9355	1950 nominal	5-8	Similar to BL-468. Six frequencies 15.0 Mc apart
Ku BAND	BL-473	* Ku band	3200-4000	4.0 max.	Transmission cavity weight, 4 oz. Temperature coefficient, .02 Mc/°C.
	BL-474	16,280	5000-8000	15 max.	Fixed tuned, dual mode cavity. Temperature coefficient, .02 Mc/°C.
	BL-452	16,230-16,330	5000-8000	15 max.	Tunable, dual mode cavity with micrometer calibration. Temperature coefficient, .02 Mc/°C.

* Per customer requirements.

MIXER DIODES

MAX. VSWR IN STANDARD MIXER	POWER LEVEL mW	BURN-OUT (ERGS)	CALC. OVERALL RECEIVER NOISE FIGURE [6]	IF IMP. (OHMS)	STAND-ARD MIXER [7]
—	0.5	2.0	10.3	200-800	JAN 124
—	0.5	2.0	8.3	200-800	JAN 124
1.5	0.5	2.0	7.34	350-450	JAN 124
1.3	0.5	5.0	7.0	350-450	JAN 124
1.3	0.5	5.0	7.0	350-450	JAN 264
1.3	0.5	5.0	6.5	350-450	JAN 264
1.3	0.5	5.0	6.0	350-450	JAN 264
—	1.0	0.3	—	200-800	JAN 105
—	1.0	1.0	9.8	325-475	JAN 105
1.3	1.0	1.0	8.3	350-450	JAN 105
1.3	1.0	2.0	7.5	335-465	JAN 105
1.3	1.0	2.0	7.5	335-465	JAN 105
1.5	1.0	1.0	8.3	325-475	JAN 105
1.3	1.0	2.0	7.0	335-465	JAN 105
1.5	—	2.0	9.8	325-475	——
1.3	1.0	2.0	7.5	325-465	JAN 105
1.3	1.0	2.0	7.0	325-465	JAN 105

NOTES

1. Forward polarity—Path of easy current flow (conventional) is from base to pin. Base is positive with respect to pin.
2. Reverse polarity—Path of easy current flow (conventional) is from pin to base. Base is negative with respect to pin.
3. Pairs of Bomac mixer diodes are available matched within the following limits:
   IF impedance—25 ohms
   Conversion loss—0.3 db
   Crystal current matched to within 5% of lower value.
4. Designations ending in MR indicate diode pairs having one forward and one reverse polarity diode.
5. Reversible polarity cartridge types are electrically and mechanically identical to their fixed polarity counterparts and are directly interchangeable with indicated fixed polarity types.
6. Overall noise figure is calculated from:
   $N = CL(N_{IF}+N_R-1)$. N_{IF} is assumed to be 1.5 db at 30 Mc.
7. JAN 124 coaxial mixer will soon be replaced by an equivalent waveguide mixer.
8. 1N23WE and 1N21WE are environmentally tested under extreme conditions according to MIL-E-1/1117 and MIL-E-1/1115 JAN specifications, respectively.
9. BL169 diodes are specially designed for doppler radar systems requiring relatively constant overall noise figures over large local-oscillator power levels. Frequency range is 8600-9700 Mc.

PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

The Above Products Are Manufactured by Bomac Laboratories . . . . . Beverly, Massachusetts

VARIAN WATER LOADS

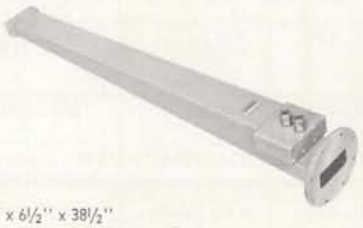
- MEASURE UHF AND MICROWAVE POWER
- VERY LOW VSWR
- TERMINATE BOTH PRESSURIZED AND UNPRESSURIZED TRANSMISSION LINE SYSTEMS
- SERVE AS HIGH OR LOW POWER DUMMY LOADS
- OPERATE EITHER PULSED OR CW
- PROVIDE ACCURATE MEASUREMENTS OF AVERAGE POWER

Varian Water Loads and Calorimeters provide an accurate and convenient means for measuring RF power. Loads are conservatively rated in terms of average and peak power and the waveguide or line portion of most models is pressure tight for applications where a pressurized transmission line is required. Loads not pressure tight may be modified on request. VSWR is much lower than the specified maximum over most of the frequency range; data on lower values of VSWR for specified frequencies furnished on request.

V-4022B 17⅞" x 3-1/16" x 17¼"
V-4022C 17⅞" x 3-1/16" x 21¼"

V-4022B Water Load
(Basic Load Illustrated)
7.1 to 10.2 kMc
5 kW average
0.5 Mw peak
VSWR <1.15

V-4022C Water Load
(Basic Load with Waveguide Taper Section)
7.1 to 12.4 kMc
5 kW average
0.3 Mw peak
VSWR <1.15



6" x 6½" x 38½"

V-4045 Water Load
2.7 to 4.8 kMc
30 kW average
3 Mw peak
VSWR <1.15

V-4023A 3⅝" x 4⅛" x 23-1/16"
V-4023B 3⅝" x 4⅛" x 25⅞"

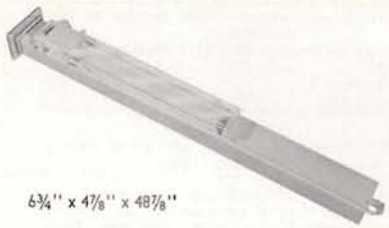
V-4023A Water Load
4.8 to 7.5 kMc
8 kW average
2 Mw peak
VSWR <1.15

V-4023B Water Load
4.0 to 6.0 kMc
8 kW average
2 Mw peak
VSWR <1.15

6" x 6½" x 48"

New

V-4045D
7.0 to 10.2 kMc
30 kW average
0.5 Mw peak
VSWR <1.15



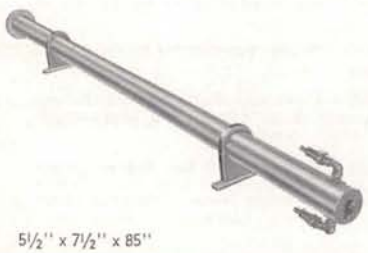
6¾" x 4⅞" x 48⅞"

V-4041 Water Load
1.7 to 2.6 kMc
12 kW average
VSWR <1.15

13¼" x 14⅝" x 129¼"

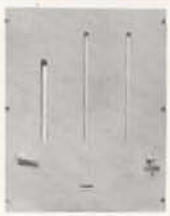
New

V-4044
0.76 to 0.98 kMc
75 kW average
VSWR <1.20



5½" x 7½" x 85"

V-4042 Water Load
0.47 kMc to 1.2 kMc
15 kW average
VSWR <1.15



OVERALL ACCURACY
±2% ABOVE 20% OF
MAXIMUM FLOW

CALORIMETERS

V-4030-7A 7 kW Nominal, for Standard 19" Rack Mounting

V-4030-7B 7 kW Nominal, for Laboratory Table

V-4030-14A 14 kW Nominal, for Standard 19" Rack Mounting

V-4030-14B 14 kW Nominal, for Laboratory Table

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

ORTHOMODE® HYBRID MIXERS

Varian ORTHOMODE® balanced mixers are compact, high performance devices designed to furnish wideband operation without adjustment. Their unique design saves space and weight and provides sensitivity identical with that of conventional balanced mixers. These mixers are now available in standard types for several frequency ranges. Additional models are under development.

These devices are also used as balanced modulators. They may be supplied in special configurations which include the combination of a mixer as a local oscillator and an unwanted sideband suppression filter. Other configurations may include the combination of two mixers for the suppression of the unwanted sideband by cancellation. Custom shapes are available on special order.

ORTHOMODE® hybrid mixers are particularly useful in applications where environmental or space limitations present difficult packaging problems. The single IF output of these mixers offers the advantage of low shunt capacitance.

These mixers can be supplied with coaxial or special waveguide signal and local-oscillator inputs.

Varian Associates welcomes your inquiries for the development of ORTHOMODE® mixers for new or existing applications.

V-8302A

V-8303B

V-8306B

V-8309B

TYPE NUMBER	V-8302A	V-8302B	V-8303B	V-8306B	V-8308B	V-8309B
Available Frequency Range (kMc)	8.5 to 9.6	8.5 to 9.6	5.85 to 7.85	7.5 to 8.5	9.5 to 10.8	3.95 to 5.85*
Operating Frequency Range Without Adjustment (kMc)	8.5 to 9.6	8.5 to 9.6	Any 1 kMc* band	7.5 to 8.5	Any 400 Mc* band	Any 1 kMc* band
Typical Noise Figure Including 1.5 db IF and 3 db Image (db)	8.5	9.0	8.5	8.0	10.0	8.0
Signal Input VSWR, max.	2.0	2.0	2.0	2.0	2.5	2.0
Signal Input Connector Mates With	UG39/U	UG39/U	UG344/U	UG51/U	UG39/U	UG149/U
L.O. Input VSWR, max.	†	2.0	2.0	2.0	2.5	2.0
L.O. Input Connector Mates With	UG39/U	UG39/U	UG344/U	UG51/U	UG39/U	UG149/U
IF Output Connector**	Microdot	Microdot	BNC	BNC	Microdot	BNC
IF Output Impedance	200 Ω, 10 μμf	200 Ω, 10 μμf	200 Ω, 10 μμf	200 Ω, 10 μμf	200 Ω, 10 μμf	200 Ω, 10 μμf
Crystals	BL172MR	BL172MR	1N415EMR	1N415EMR	BL172MR	1N415EMR
Approx. Mixer Dimensions (in)	2 x 1⅝ x ¾	2 x 1⅝ x 1⅛	3⅛ Dia x 1⅜	1⅞ x 1⅞ x 1⅛	2 x 1⅝ x 1	3⅝ Dia x 1½
Approx. Weight (oz)	2	2.6	7	3	2.2	8.2

* Customer specifies desired center frequency ** Other types available on request † L.O. klystron mounts directly on V-8302A

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RF PACKAGES

PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE kMc	LINE SIZE	FEATURE
BLP-003D	R.F. package for AN/SPS-21	5.48-5.62	1.0" × 2.0"	Noise figure 10.5 db, includes: 2 diodes (1N23C), magnetron (BL-244); klystron, TR (6115); duplexer and mixer (6639/BL-46)
BL-539	R.F. package	8.5-9.7	0.5" × 1.0"	P peak, 250 Kw, includes balanced duplexer, balanced receiver mixer and balanced AFC mixer
BL-557	R.F. package	15.9-16.9	0.391" × 0.702"	P peak, 100 Kw, includes: balanced duplexer, balanced receiver mixer and balanced AFC mixer
BLP-027D	R.F. package	23.7-24.3	0.25" × 0.5"	P peak, 38 to 50 Kw, includes: duplexer, balanced receiver and AFC mixers

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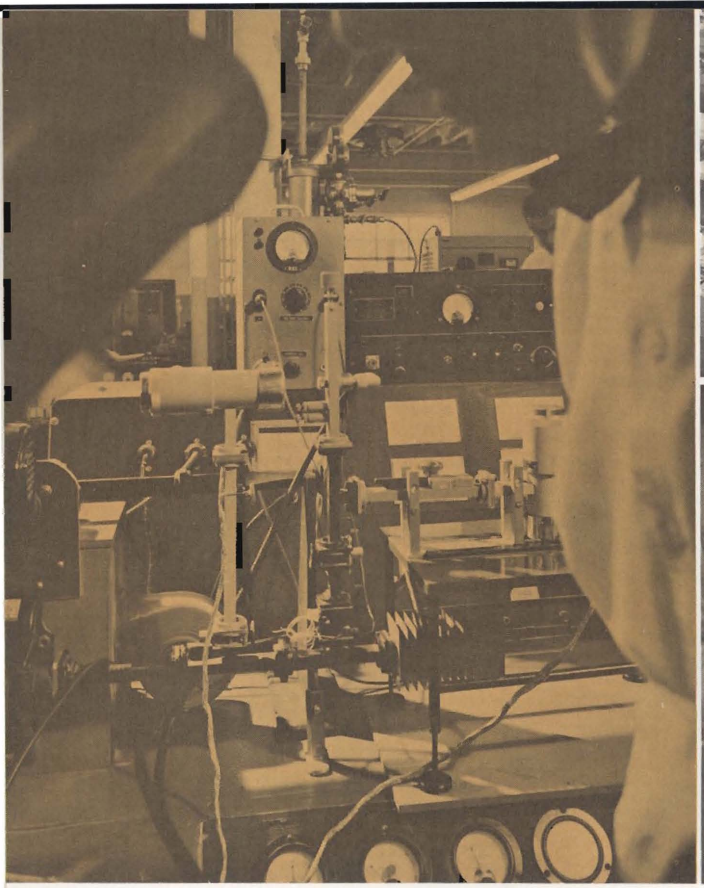
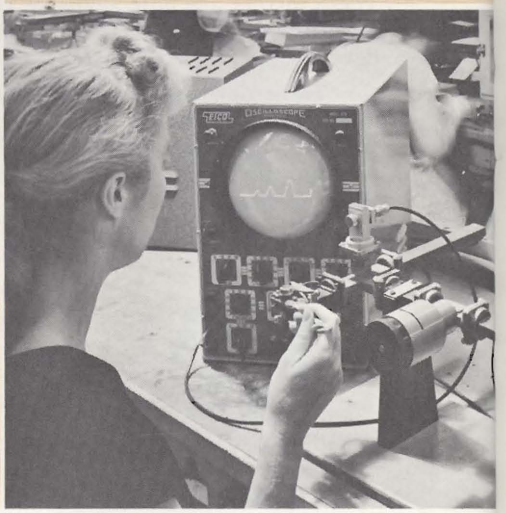
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73



GAS



Bomac designs and manufactures the most complete line of gas switching tubes available anywhere today. The scope of Bomac TR devices is virtually unlimited as far as the state of the art is concerned.

- In TR tubes there is a type for every known application covering all microwave frequency bands. Single or dual, TR and shutter and dual TR and shutter. These products may be fixed-tuned or tunable, depending on design requirements.
- ATR devices are fixed-tuned—low or high Q—miniaturized. Special shapes and mounts are available.
- Wherever attenuation is required in the duplexer before the TR, pre-TR's can be supplied. These are designed to operate up to 100 megawatts.
- Bomac was the first to develop shutter tubes and integral TR combinations. These may be supplied in any microwave frequency.
- Pressurizing windows are available for all waveguide sizes, having broadband characteristics with low insertion loss. Temperature range from −55°C to +100°C and 30 lb/sq. inch gauge pressure in either direction.
- Bomac also manufactures a complete line of gaseous diodes, or surge protectors. These are designed in a wide range of breakdown voltages, from 300 volts to 50 kilovolts, providing protection within narrow voltage limits anywhere within this range.

For any specialized application or further information on Bomac products, please contact our Sales Engineering Department.

SWITCHING TUBES

ARRANGED BY FREQUENCY BANDS

UHF
CELL TYPE
TR

BL-999

PRODUCT NUMBER	TEST FREQUENCIES Mc	POWER LEVEL	FEATURE
BL-622	400-450	2 Mw	Fixed tuned, flange mount, 3⅛ coax.
7309/BL-693	400-450	2 Mw	Fixed tuned, flange mount, 3⅛ coax.
BL-929	400-450	2 Mw	Fixed tuned, flange mount, 3⅛ coax.
BL-930	400-450	20 Kw	Fixed tuned, flange mount, 3⅛ coax.
7324/BL-931	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax.
BL-931A	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax.
BL-984	409-417	20 Kw	Fixed tuned, plug-in mount, 6⅛ coax.
BL-991	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax.
BL-994	400-450	20 Kw	Fixed tuned, plug-in mount, 3⅛ coax.
BL-995	400-450	2 Kw	Fixed tuned, plug-in mount, ⅞ coax.
BL-999	400-450	2 Kw	Fixed tuned, plug-in mount, ⅞ coax.
BLT-004	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax.
BLT-005	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax.
BLT-018	400-450	2 Kw	Fixed tuned, plug-in mount, ⅞ coax.
BLT-019	400-450	2 Mw	Fixed tuned, plug-in mount, 3⅛ coax. Metal reservoir
BLT-020	400-450	20 Kw	Fixed tuned, plug-in mount, 3⅛ coax.
BLT-021	400-450	20 Kw	Fixed tuned, plug-in mount, ⅞ coax.
BL-690	400-450	2 Mw	Tunable, plug-in mount, external cavity
BL-959	409-417	2 Mw	Fixed tuned, plug-in mount, 6⅛ coax.

L BAND
TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6633/BL-37A	1220-1365	1292	2000	Broadband TR pressurizable
7166/BL-933	1215-1365	1292	2000	Broadband TR, 7" overall length
1B40	—	1100	1	Electrodeless discharge
BL-966	1215-1355	1285	500	Cell type, tunable, special disc
6322/BL-25	1215-1355	1285	450	Cell type, tunable

L BAND
ATR

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
BL-640A	1300	2000	Tuned in full height guide, pressurizable
BL-664A	1300±5%	2000	Has flange suitable for pressurization
6962/BL-665	1285±5%	2000	Low Q double iris window, ½ height guide
BL-665A	1285±5%	2000	Has flange suitable for pressurization

L BAND
Pre-TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6605/BL-96A	1250-1350	1300	2000	Pressurizable, broadband
7152/BL-612	1250-1350	1300	3000	Ceramic window, broadband
BL-612A	1250-1350	1300	3000	Short recovery time, RT 30 μs (max.)
BL-612B	1250-1350	1300	3000	Insertion loss 0.3db (max.)
BL-920	1250-1350	1300	5000	Dual pre-TR, has folded cylinder window
5939A	1250-1350	1300	550	Used in pairs, dumbbell type
6260	1250-1350	1300	2000	Used in pairs
BLW-005	1250-1350	1300	5000	Folded cylinder

L BAND
Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6634/BL-99	1250-1350	1300	5000	For use with sidewall couplers, bandpass, RT 150 μs

L BAND
Crystal Protector

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BLS-509	1250-1350	1300	50	Min. firing power 20 watts (peak)

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PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

S BAND TR

BL-969

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-969	2600-3000	2800	750	Coaxial output TR, broadband
1B27	—	3000	50	Cell type, tunable, 2 disc
1B55	3365-3740	3550	750	Broadband
1B58A	2600-3000	2800	750	Band pass, fixed tuned
1B62	2700-3300	3000	350	Cell type, fixed tuned, 2 disc
5853	2900-3200	3050	750	Broadband
5927	3100-3500	3300	750	Broadband
6117	2689-2939	2802	750	Broadband, pressurizable mounting
721B	2700-3300	3000	350	Cell type, fixed tuned

S BAND ATR

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
1B44	2750	750	Fixed tuned
1B52	3625	750	Fixed tuned
1B53	3479	750	Fixed tuned
1B56	2850	750	Fixed tuned
1B57	3325	750	Fixed tuned
5792	2950	750	Fixed tuned
5793	3050	750	Fixed tuned
5921	3200	750	Fixed tuned
5922	3400	750	Fixed tuned
6024	2800	750	Fixed tuned
BL-41	2750	750	Fixed tuned — 15μs R.T.
BL-660	2800	1000	Fast recovery time
BL-963	2950	1000	
BL-964	3050	1000	
BL-946	2850	1000	

S BAND Pre-TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
1B38	2650-2950	2800	750	Broadband
1B54	3300-3700	3500	750	Broadband

S BAND Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6636/BL-87	2700-2900	2800	750	Broadband for use with sidewall couplers
BL-638	2900-3200	3050	750	
BL-652	3400-3700	3550	750	

S BAND Dual TR and Shutter

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
BL-346	2700-2900	750	28	BL-87 with shutter
BL-357	3400-3700	750	28	BL-652 with shutter

S BAND TR and Shutter

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6602/BL-329	3100-3500	750	28	5927 plus shutter
BL-345	2664-2964	750	28	1B58 plus shutter
BL-351	2900-3200	750	28	5853 plus shutter

S BAND Crystal Protector

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-670	2700-2900	2800	10	Max. overall length 6.640"

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SWITCHING TUBES

ARRANGED BY FREQUENCY BANDS

C BAND TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6639/BL-46	5540-5560	5550	20	Tunable
BL-605	5370-5430	5400	100	Contact mounting seat
6906/BL-643	5393-5905	5650	5	Phase controlled ± 5° tracks with 6905/BL-613
5865	5395-5905	5650	300	
5925	5200-5530	5365	1000	
6624	5350-5450	5400	85	Broadband contact type input mount

C BAND ATR

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
6455/BL-61	5640	300	Fixed tuned, contact mount flange
BL-606	5400	100	Special mounting flange
6022	5365	1000	Fixed tuned
6081	5640	300	Fixed tuned
6591	5400	150	Contact mount flange

C BAND Pre-TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-954	5395-5755	5575	3000	Will not sustain ionization below 10 watts CW
BL-982	5400-5900	5650	40	Will not sustain ionization below 10 watts CW
BL-997	5250-5750	5500	1000	Dual pre-TR has folded cylinder window, 1½ in. long

C BAND Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6640/BL-60	5400-5900	5650	700	
6641/BL-86	5150-5410	5280	1000	
6905/BL-613	5400-5900	5650	3000	Ceramic windows, phase control, tracks with TR6906/BL-643
BL-644	5250-5310	5280	1000	

C BAND TR and Shutter

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
BL-337	5395-5905	3000	28	Ceramic window
BL-350	5340-5450	300	28	Shutter circuit uses AN connector, shortened ignitor
BL-366	5395-5905	300	6	
BL-373	5250-5750	50	48	Phase control ±5°
BL-377	5395-5905	3000	28	Input flange has all 8 holes tapped to 0.190" — 32 NF 2B

C BAND Dual TR and Shutter

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
BL-336	5400-5900	700	28	
BL-352	5400-5900	700	28	Has AN connectors
7447/BL-352A	5400-5900	700	28	Contains 12 struts between flanges, terminal board incapsulated
BL-362	5400-5900	700	115 (ac) 60 ~	Built-in power rectifier

C BAND Crystal Protector

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-971	5450-5825	5640	5	Broadband low noise figure

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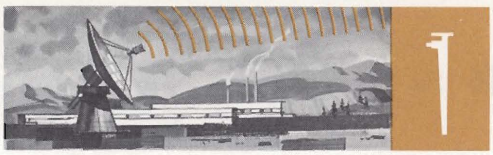
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73



	PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
Xb BAND **TR**	1B50	6550	200	Tunable
Xb BAND **ATR**	1B51	6425	200	Fixed tuned

X BAND **TR**

1B63A

1B24A

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-29	9325-9425	9375	40	Crossed guide duplexer, fixed tuned
BL-47	9325-9425	9375	10	Crossed guide duplexer, for beacon application, low firing power
6378/BL-62	8490-9600	9375	30	No reservoir, miniaturized tunable
6644/BL-95	8490-9578	9000	100	Short RT, 1.5 μs
BL-95A	8490-9578	9000	100	Short RT, 1.5 μs, extended temperature operation, no heater
1B63B	8490-9578	9000	200	1000 hr. life
5863	8490-9578	9000	250	Bandpass for RG51/U guide, 5 element tube, input flange cut, Bell Lab. flanges
6035	8490-9578	9000	200	Fixed tuned, special mechanical dimensions
6164	8490-9560	9000	250	Controlled phase shift
6232	8490-9578	9000	250	For use in RG51/U guide; Bell Lab. input, X output
6368	8490-9578	9000	1000	Tuned for small guide
6795	8490-9578	9000	200	Miniaturized contact type mounting
724B	8541-9862	9300	75	Cell type, 2 disc fixed tuned
6645/BL-95H	8490-9578	9000	100	Extended temperature operation, heater mounted on tube
7115/BL-915	9000-9400	9200	40	Weather radar, 3 element, RT 10 μs
BL-924	9250-9350	9300	0.2	Crossed guide duplexer, RT 6 μs max.
BL-948	8490-9578	9000	100	Has phase control
BL-965	8500-9600	8900	10	Crystal protection, used in RG/52 waveguide, "hot-cold," —55°C. to +85°C.
BL-990	8490-9578	9000	250	VSWR 1.5 max., "hot-cold," —55°C. to +125°C.
1B24A	—	9375	30	Tunable
1B63A	8490-9578	9000	200	Fixed tuned

X BAND **ATR**

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
6304/BL-43	9300	250	Contact type flange
6629/BL-54	8800	250	Used with RG51/U guide
6630/BL-55	9375	250	Used with RG51/U guide
6393/BL-68	9300	250	Miniaturized
6396	9300	250	Used in half-height RG52/U guide

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SWITCHING TUBES | ARRANGED BY FREQUENCY BANDS

X BAND Dual TR

6334/BL-27

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6334/BL-27	8490-9578	9000	200	
6564/BL-71	8500-9600	9000	250	4-element, used with RG-51/U guide
6642/BL-600	8490-9578	9000	250	RG-51/U input, RG-52/U output
6646/BL-604	8490-9578	9000	100	Rec. time 1.5μs (max.)
6647/BL-604H	8490-9578	9000	100	Has thermal control heaters
BL-651H	8490-9578	9000	250	Supplied with heaters and thermostat, RT 3 μs
BL-947	8490-9578	9000	100	Has phase control
7381	8490-9610	9000	150	"Hot—cold" TR, operating temp. range: −55°C. to +125°C.
BL-998	8500-9600	9000	500	Has phase control, special input flange
BLT-014	8490-9578	9000	200	Operates at +125°C., has phase control

X BAND Pre-TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-962	8500-9600	9000	250	Dual pre-TR tube used with short slot coupler with RG-51/U input, RG-52/U output

X BAND TR and Shutter

BL-367

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
6615/BL-312	8490-9578	250	28	
6565/BL-313	8490-9600	30	14	Contains one 14-volt coil plus dropping resistor for 28-volt operation, tunable
BL-338H	8490-9578	100	28	Contains heater
BL-356	8490-9578	250	28	Reversed ignitor, ignitor on right side facing tube output with shutter mechanism in upright direction
BL-359	8490-9578	200	28	RG-51/U input, RG-52/U output
BL-361	8490-9578	250	28	Contains input saddle flange, RT-1.5 μs
BL-367	8490-9578	250	28	Shutter and ignitor incapsulated, three lead wires for terminals

X BAND Dual TR and Shutter

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
6596/BL-317	8490-9578	250	28	Tapped holes both flanges, ignitor lead extended through cap
6601/BL-327	8490-9578	250	28	RG-51/U input, RG-52/U output
BL-339H	8490-9578	100	28	Contains heater
BL-341	8490-9578	250	28	RG-51/U input, RG-52/U output
BL-360H	8490-9578	100	28	Tubulation on reverse side, contains heater

X BAND Shutter Only

PRODUCT NUMBER	FREQUENCY RANGE Mc	POWER LEVEL Kw MAX.	SHUTTER CIRCUIT VOLTAGE Vdc	FEATURE
BL-325	8490-9578	1	28	
BL-365	8490-9578	1	28	Dual

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PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

GAS SWITCHING TUBES

Ku BAND TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-16	16,200-16,800	16,500	40	Tunable, integral cavity
6649/BL-56	15,000-17,000	16,000	100	Bandpass, fixed tuned
BL-908	15,500-17,500	16,500	100	Fixed bandpass, tuned
BL-967	16,000-17,000	16,500	10	Cad. plated, ±3° phase control, operating temperature 100°C.
BL-993	16,000-17,000	16,500	10	Crystal protector TR, —37°C. to +83°C. operating temperature

Ku BAND ATR

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
BL-15	16,500	40	Fixed tuned

Ku BAND Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6560/BL-35	15,000-17,000	16,000	100	Bandpass
BL-907	15,500-17,500	16,500	100	Bandpass
BL-934	16,000-17,000	16,500	100	
BL-934A	16,000-17,000	16,500	100	±3° phase control

K BAND TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6282/BL-11	23,350-24,950	24,000	35	Bandpass, fixed tuned
6650/BL-67	23,630-24,500	23,984	100	No reservoir
BL-621	23,630-24,580	23,984	24	Miniaturized reservoir
1B26	23,630-24,580	23,984	24	Tunable

K BAND ATR

PRODUCT NUMBER	CENTER FREQUENCY Mc	POWER LEVEL Kw MAX.	FEATURE
BL-627	24,000	30	Reduced overall length, countersunk exhaust tube
1B36	24,000	30	Fixed tuned

K BAND Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-645	23,200-24,800	24,000	30	
BLT-036	23,200-24,800	24,000	30	

Ka BAND TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
BL-639	33,500-35,500	34,500	20	Broadband TR
BLT-037	34,500-35,200	—	6	Broadband TR

Ka BAND Dual TR

PRODUCT NUMBER	FREQUENCY RANGE Mc	CENTER FREQ. Mc	POWER LEVEL Kw MAX.	FEATURE
6685/BL-616	33,500-36,250	34,500	20	

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IGNITOR POWER SUPPLIES

PRODUCT NUMBER	SPECIAL DEVICES
BLN-004	Transistorized ignitor supply, input—28 Vdc (nom.) output 750 V at μA (nom.) miniaturized
BLN-009	Ignitor supply, input 115 V—60 cycle AC 800 V at 200 microamperes (max.) output

SURGE PROTECTORS

OUTLINE 1

TUBE TYPE	BREAKDOWN Kv MIN.	BREAKDOWN Kv MAX.
BL-745	5	6
BL-752	5.5	6.5
BLN-005	6.5	7.5
BL-724	7.2	7.7
BL-717	8.5	10
BL-718	10.5	12
BL-787	11.5	12.6
BL-778	14	16
BLN-001	16	18
BL-700	18	20
BL-716	24	27
BLN-003	31	40
BL-146	32	35

OUTLINE 2

TUBE TYPE	BREAKDOWN Kv MIN.	BREAKDOWN Kv MAX.
BL-735	16	18
BL-784	19	21
BL-785	23	25
BLN-010	39	45

OUTLINE 3

TUBE TYPE	BREAKDOWN Kv MIN.	BREAKDOWN Kv MAX.
BL-744	1.5	2.5
BLN-006	2.3	3.0

OUTLINE 4

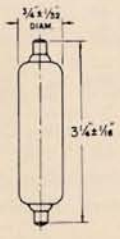
TUBE TYPE	BREAKDOWN Volts MIN.	BREAKDOWN Volts MAX.
BL-779	200	300

OUTLINE 5

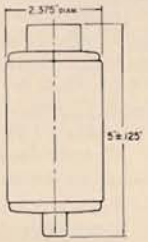
TUBE TYPE	BREAKDOWN Kv MIN.	BREAKDOWN Kv MAX.
1B31	6.8	9.9

OUTLINE 6

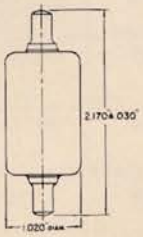
TUBE TYPE	BREAKDOWN Kv MIN.	BREAKDOWN Kv MAX.
1B22	2	3



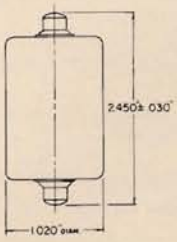
OUTLINE 1



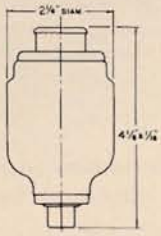
OUTLINE 2



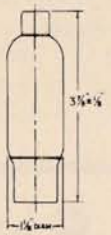
OUTLINE 3



OUTLINE 4



OUTLINE 5



OUTLINE 6

NETWORK SWITCHING TUBE

BLN-008	This tube is designed to change pulse characteristics in radars. 15 kv peak, coil 28 Vdc

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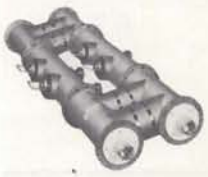
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

MICROWAVE

UHF



BL-595

PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE Mc	LINE SIZE	FEATURE
BLP-009D	Duplexer, branched coax. line	406-450	3⅛" coaxial	P peak, 3 Mw max, P average, 5 kw max.
BL-595	Duplexer	413	6⅛" coaxial	P peak, 2.0 Mw, P average, 10 kw
BLP-024D	Duplexer	425	WR2100	P peak, 2.5 Mw, P average, 150 kw
BLP-010D	Monoplexer	406-450	⅞" coaxial	P peak, 30 kw, P average, 50 watts
BL-596	Hybrid	400-450	⅞" coaxial	P peak, 200 kw
BLP-004H	Hybrid	400-450	3⅛" coaxial	P peak, 2.0 Mw
BLP-012H	Hybrid	425	Slabline	3 db coupling "N" and ⅞" coaxial fittings
BL-597	Load, dry	400-450	1⅝" coaxial	P peak, 20 kw, P average, 20 w, VSWR 1.2 max.

L BAND

PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE kMc	LINE SIZE	FEATURE
BL-506	Duplexer, branch guide	1.180-1.220	3.41" × 6.66"	P peak, 3 kw, UG60A/U coaxial input and output
BL-591	Duplexer, branch guide	1.250-1.350	3.41" × 6.66"	P peak, 1 Mw, P average, 3 kw, 1⅝" coaxial input and output
BLP-005D	Duplexer, branch guide	1.250-1.350	3.41" × 6.66"	P peak, 2 Mw

S BAND

PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE kMc	LINE SIZE	FEATURE
BLP-061	Power divider, variable	2.6-3.9	1½" × 3"	P peak, 2.7 Mw pressurized, 2.2 Mw unpressurized
BL-584	Diplexer	2.72-2.98	1½" × 3"	P peak, 750 kw, insertion loss, 0.3 db max.; isolation, 25 db min.
BL-585	Diplexer	2.84-3.00	1½" × 3"	P peak, 750 kw, insertion loss, 0.3 db max.; isolation, 25 db min.
BL-520	Duplexer, branch guide	2.98-3.02	1½" × 3"	P peak, 20 kw, UG46/U coaxial input and output
BLP-066	Directional coupler, crossguide	2.6-3.4	1½" × 3"	Incident power, 1.1 Mw, coupling, 20, 30, or 40 db; directivity, 15 db
BLP-071	Directional coupler, sidewall	2.6-3.4	1½" × 3"	Incident power, 2.2 Mw, coupling, 20, 30, or 40 db; directivity, 20 db min.
BLP-076	Directional coupler, topwall	2.6-3.4	1½" × 3"	Incident power, 1.1 Mw, coupling, 10 or 20 db; directivity, 40 db min.

C BAND

BLP-049T

PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE kMc	LINE SIZE	FEATURE
BLP-060	Power divider, variable	5.2-5.9	1" × 2"	P peak, 1.7 Mw pressurized, 0.9 Mw unpressurized
BLP-087E	Diplexer	5.2-5.9	1" × 2"	P peak, 1.7 Mw pressurized, 0.9 Mw unpressurized; isolation, 25 db min.
BLP-048T	Transition to coaxial line	5.4-5.9	1" × 2"	Includes Sm plug, VSWR 1.10 max.
BLP-049T	Transition to coaxial line	5.2-6.0	1" × 2"	Includes TNC plug, VSWR 1.10 max.
BLP-050T	Transition to coaxial line	5.2-5.9	1" × 2"	Includes N jack, VSWR 1.10 max.
BLP-065	Directional coupler, crossguide	5.2-5.9	1" × 2"	Incident power, 470 Kw, coupling, 20, 30 or 40 db; directivity, 15 db min.
BLP-070	Directional coupler, sidewall	5.2-5.9	1" × 2"	Incident power, 940 Kw, coupling, 20, 30, or 40 db; directivity, 20 db min.
BLP-075	Directional coupler, topwall	5.2-5.9	1" × 2"	Incident power, 470 Kw, coupling, 10 or 20 db; directivity, 40 db min.
BL-594	Duplexer, balanced	5.25-5.75	1" × 2"	P peak, 1 Mw

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PLUMBING

DUPLEXERS • DIPLEXERS • MONOPLEXERS • HYBRIDS • POWER DIVIDERS • TRANSITIONS • NOISE SOURCES

BLP-059

	PRODUCT NUMBER	PRODUCT	FREQUENCY RANGE kMc	LINE SIZE	FEATURE
X BAND	BLP-044D	Duplexer, balanced	8.490-9.578	½" × 1"	P peak, 200 Kw max.
	BLP-059	Power divider, variable	8.5-9.6	½" × 1"	400 Kw pressurized, 200 Kw unpressurized
	BLP-051E	Diplexer	8.5-9.6	½" × 1"	Isolation, 25 db min., includes termination
	BLP-045T	Transition to coaxial line	8.3-8.7	½" × 1"	Includes TNC plug, VSWR, 1.10 max.
	BLP-046T	Transition to coaxial line	8.7-9.1	½" × 1"	Includes TNC plug, VSWR, 1.10 max.
	BLP-047T	Transition to coaxial line	9.1-9.5	½" × 1"	Includes TNC plug, VSWR, 1.10 max.
	BLP-063	Directional coupler, crossguide	8.5-9.6	½" × 1"	Incident power, 100 Kw, coupling, 20, 30, or 40 db; directivity, 15 db min.
	BLP-068	Directional coupler, sidewall	8.5-9.6	½" × 1"	Incident power, 200 Kw, coupling, 20, 30, or 40 db; directivity, 20 db min.
	BLP-073	Directional coupler, topwall	8.5-9.6	½" × 1"	Incident power, 100 Kw, coupling, 10 or 20 db; directivity, 40 db min.
XL BAND	BLP-083	Power divider, variable	8.5-9.6	⅝" × 1¼"	P peak, 700 Kw pressurized, 350 Kw unpressurized
	BLP-084E	Diplexer	8.5-9.6	⅝" × 1¼"	P peak, 700 Kw pressurized, 350 Kw unpressurized; isolation, 25 db min.
	BLP-064	Directional coupler, crossguide	8.5-9.6	⅝" × 1¼"	Incident power, 175 Kw, coupling, 20, 30, or 40 db directivity, 15 db min.
	BLP-069	Directional coupler, sidewall	8.5-9.6	⅝" × 1¼"	Incident power, 350 Kw, coupling, 20, 30, or 40 db; directivity, 20 db min.
	BLP-074	Directional coupler, topwall	8.5-9.6	⅝" × 1¼"	Incident power, 175 Kw, coupling, 10 or 20 db; directivity, 40 db min.
	BL-542	Duplexer, balanced	8.490-9.578	⅝" × 1¼" input ½" × 1" output	P peak, 200 Kw, includes 28 V shutter
Ku BAND	BLP-062	Directional coupler, crossguide	16.0-17.0	0.391" × 0.702"	Incident power, 60 Kw, coupling, 20, 30, or 40 db; directivity, 15 db min.
	BLP-067	Directional coupler, sidewall	16.0-17.0	0.391" × 0.702"	Incident power, 120 Kw, coupling, 20, 30, or 40 db; directivity, 20 db min.
	BLP-072	Directional coupler, topwall	16.0-17.0	0.391" × 0.702"	Incident power, 60 Kw, coupling, 10 or 20 db; directivity 40 db min.
	BLP-058	Power divider, variable	16.0-17.0	0.391" × 0.702"	P peak, 240 Kw pressurized, 120 Kw unpressurized
	BLP-086E	Diplexer	16.0-17.0	0.391" × 0.702"	P peak, 240 Kw pressurized, 120 Kw unpressurized; isolation, 25 db min.
Ka BAND	BL-527	Dual TR balanced duplexer with short slot hybrids	33.50-36.25	0.112" × 0.224"	Integral design with hybrids permanently attached Power level Kw max. 20

NOISE SOURCES

	PRODUCT NUMBER	FREQUENCY RANGE kMc	NOISE db	OPERATING CURRENT	RECOMMENDED MODE OF OPERATION
X BAND	BL-721	8.400-12.500	15.28 ± 0.25	200 ma	DC
	6357	8.200-12.400	15.28 ± 0.25	200 ma	DC
	BL-592	8.5-10.1	14.75 ± 0.25	115 ma	AC
Ku BAND	BLP-033	12.4-18.0	14.5-18.5	115 ma	AC

The Above Products Are Manufactured by Bomac Laboratories . . . . . Beverly, Massachusetts

PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

MICROWAVE

S BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MATES WITH UG	MOUNTING
BL-741	2.7-2.9	2800	1.20	750	48/U	53/U	Flange
BL-712	2.8-3.2	3000	1.20	1000	48/U	53/U	Flange
BL-713	2.6-3.7	3150	1.20	1000	48/U	54A/U	Flange
BL-124	2.675-2.925	2800	1.10	1000	48/U	—	Solder
BL-739	2.6-3.7	3100	1.30	—	48/U	—	Solder
BL-743	—	3300	1.10	1 mw	48/U	—	Solder

C BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MOUNTING
BL-704	4.9-5.1	5000	1.15	100	49/U	Solder
BL-730	4.9-5.1	5000	1.15	100	49/U	Solder
BL-769	4.9-5.1	5000	1.15	100	49/U	Solder
BL-141	5.1-5.32	5210	1.10	100	49/U	Solder
BL-746	5.25-5.31	5280	1.05	500	49/U	Solder
BL-747	—	5975	—	250	50/U	Solder
BL-780	5.35-5.45	5400	1.12	750	49/U	Solder
BL-738	5.1-5.9	5500	1.25	100	49/U	Solder
BL-134	5.2-5.9	5550	1.20	75	59/U	Solder
BL-742	5.45-5.825	5637	1.12	750	49/U	Solder

Xb BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MOUNTING
BL-123	6.15-6.85	6500	1.30	100	50/U	Solder

X BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MATES WITH UG	MOUNTING
BL-119	8.7-8.9	8800	1.10	200	52/U	40/U	Flange
BL-132	8.49-9.578	9000	1.12	200	52/U	40A/U	Flange
BL-722	8.49-9.578	9000	1.12	200	51/U	52A/U	Flange
BL-710	8.5-9.6	9050	1.12	200	52/U	52A/U	Flange
BL-112	8.83-9.33	9080	1.10	200	52/U	40/U	Flange
BL-117	8.83-9.33	9080	1.10	200	52/U	40A/U	Flange
BL-122	8.645-9.555	9100	1.15	200	52/U	40A/U	Flange
BL-139	8.49-9.6	9100	1.15	250	51/U	52A/U	Flange
BL-145	9.15-9.6	9375	1.10	200	52/U	40A/U	Flange
BL-755	8.85-9.15	9000	1.20	100	52/U	—	Solder
BL-794	8.4-9.6	9000	1.20	200	52/U	—	Solder
BL-789	8.99-9.21	9100	1.10	150	52/U	—	Solder
BL-107	9.21-9.41	9310	1.10	100	51/U	—	Solder
BL-114	9.2-9.42	9310	1.10	150	52/U	—	Solder
BL-125	9.2-9.42	9310	1.10	150	52/U	—	Solder
BL-764	9.2-9.4	9375	1.10	150	52/U	—	Solder
BL-788	9.29-9.51	9400	1.10	150	52/U	—	Solder
BL-136	9.4-9.6	9500	1.20	150	52/U	—	Solder
BL-774	9.6-10.2	9800	1.10	150	52/U	—	Solder
BLW-026	8.1-12.4	1025	1.15	200	52/U	40A/U	Flange

BLW-026

Ku BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQ. Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MOUNTING
BL-777	12.4-18.0	15,200	1.12	100	91/U	Flange
BL-144	15.84-16.16	16,000	1.08	100	91/U; 107/U	Flange
BL-133	15.0-17.0	16,000	1.15	75	91/U	Flange
BL-711	12.5-13.5	13,000	1.25	50	91/U	Solder
BL-707	13.45-13.55	13,500	1.10	50	91/U	Solder

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TUBE ACCESSORIES

Ku BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQUENCY Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MOUNTING
BL-729	13.51-13.48	13,500	1.07	50	91/U	Solder
BL-731	13.45-13.55	13,500	1.10	50	91/U	Solder
BL-143	15.92-16.08	16,000	1.10	50	91/U	Solder
BL-754	16.0-16.2	16,100	1.10	80	91/U	Solder
BL-116	16.3-16.7	16,500	1.10	50	91/U	Solder

K BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQUENCY Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MOUNTING
BL-715	23.1-24.9	24,000	1.20	50	53/U	Solder

Ka BAND Pressurizing Windows

PRODUCT NUMBER	FREQUENCY RANGE kMc	CENTER FREQUENCY Mc	VSWR MAX.	PEAK POWER Kw	WAVEGUIDE SIZE RG	MATES WITH UG	MOUNTING
BL-737	34.2-34.8	34,500	1.15	20	96/U	600/U	Solder
BL-760	34.6-35.2	34,900	1.15	20	96/U	600/U	Solder

The Above Products Are Manufactured by Bomac Laboratories . . . . . Beverly, Massachusetts

VA-1011A
Connector

Silicone rubber connector designed for reflector connection to VA-203B klystron. Can also be used on klystrons with standard 0.250-inch reflector cap. Eighteen-inch nominal silicone rubber lead.

VA-1011B
Connector

Silicone rubber connector designed for cathode and heater connections to VA-203B klystron. Can also be used on Varian klystrons with 3-pin bases. Eighteen-inch nominal silicone rubber leads.

VA-1120
Adapter

The VA-1120 adapter consists of a section of RG-50/U waveguide 0.710 inch long with two UG-344/U flanges. The VA-220 klystron is a direct replacement for the X-26 klystrons in systems where the effective resonator position is not important. In those systems where the effective resonator position is critical, use of the VA-1120 adapter will permit exact replacement.

VA-1121
Adapter

The VA-1121 adapter is a round UG-149A/U waveguide flange that has tapped holes to accommodate a rectangular CMR-187 flange. Mates with VA-220J flange.

VA-1122
Adapter

The VA-1122 adapter is a round UG-344/U cover flange that has tapped holes to accommodate a rectangular CMR-137 flange. Mates with VA-222 series flange.

VA-1123
Adapter

The VA-1123 serves to adapt the round rf output terminal of the VA-800 klystron to the UG-435A/U waveguide flange and type WR 430 waveguide. It becomes a permanent part of the waveguide assembly.

V-1150
Insulator

The V-1150 mica insulator for UG-39/U or UG-39A/U flange. 1⅝ inches square with 0.185-inch mounting holes.

V-1151
Insulator

Mica insulator for UG-344/U or UG-343A/U flange. 3½-inch diameter with 0.218-inch mounting holes.

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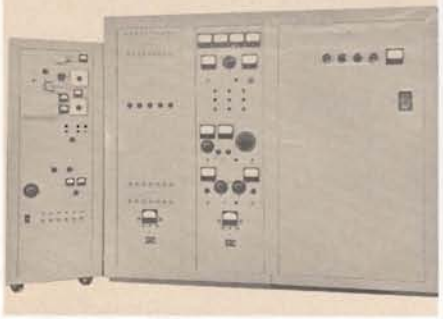
PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

MICROWAVE

MICROWAVE SYSTEMS

The Radiation Division of Varian Associates develops and manufactures unique microwave components, electronic systems and equipment for military and commercial applications. Special power supplies, high power modulators, power amplifiers for radar and communications applications, stable microwave exciters and drivers, and complex test instrumentation can be supplied to customer specifications. Careful design and conservative ratings insure reliable, high quality performance with ease of maintenance. Inquiries are invited on equipment for your special requirements.

PULSED POWER AMPLIFIER & DRIVER

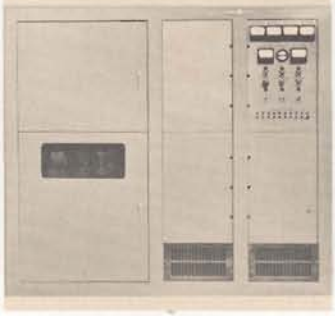


V-4659

- *Variable Pulse Repetition 50-1200 Pulse/Sec.*
- *Variable Pulse Width of 1, 2, 6 u Sec.*
- *Self-Contained*

Included among the many Varian special-built microwave and electronic equipments is this pulsed klystron transmitter. This equipment utilizes a VA-87 klystron to provide over 1 megawatt peak power. The complete unit shown includes rf driver, modulator and klystron housing.

HIGH VOLTAGE POWER SUPPLY

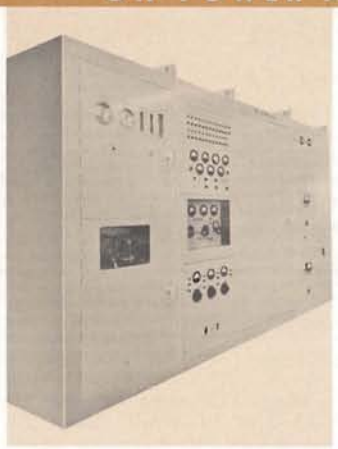


V-7214

- *90 KW Output*
- *Manual and Remote Operation*
- *High-Regulation and Interlocks*

This typical equipment is a high voltage power supply for a 20 kW X-band power amplifier. Varian's Radiation Division has been involved for several years in design and manufacture of special equipment and components for challenging applications. Difficult requirements for modulators, power amplifiers and power supplies, used in radar and communication systems, have been met successfully.

CW POWER AMPLIFIER



V-4674

- *High Gain*
- *High Power*
- *Self-Contained*

Another outstanding example of Radiation Division's ability in custom system capabilities is this 10 kW CW power amplifier using the VA-800 klystron. Special design and construction of this equipment was accomplished for a government application in troposphere scatter communication. Complete interlock and overload devices, for protection of both personnel and equipment, are incorporated features in this and all similar units.

PULSE MODULATOR & POWER SUPPLY

V-7601

- *High Repetition Rate*
- *For Gridded Klystrons*
- *40% Duty*

A representative example of some special contract equipment is this power supply and pulse modulator unit. This unit supplies a klystron with highly accurate, regulated voltages. The pulse modulator is capable of repetition rates to 300 kc. Radiation Division builds small and large power supplies and also is well qualified to produce special modulators.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

PULSE MODULATOR	*Mfg. by Bomac Labs. Beverly, Mass.*	**BL-030**	10 kW pulse modulator 1 microsecond nominal at 2,000 pulses per second

PARAMETRIC AMPLIFICATION

New

WIDEBAND UHF PARAMETRIC AMPLIFIER

V-8350

Low overall noise figure	2.0 db
Stable gain	20 db
Wide instantaneous bandwidth (3 db)	35 to 40 Mc

Available at customer specified center frequency in range 500 to 1000 Mc.

The V-8350 comprises two wideband variable reactance up-converters for simultaneous amplification and frequency conversion of a signal and its associated source of local oscillator power.

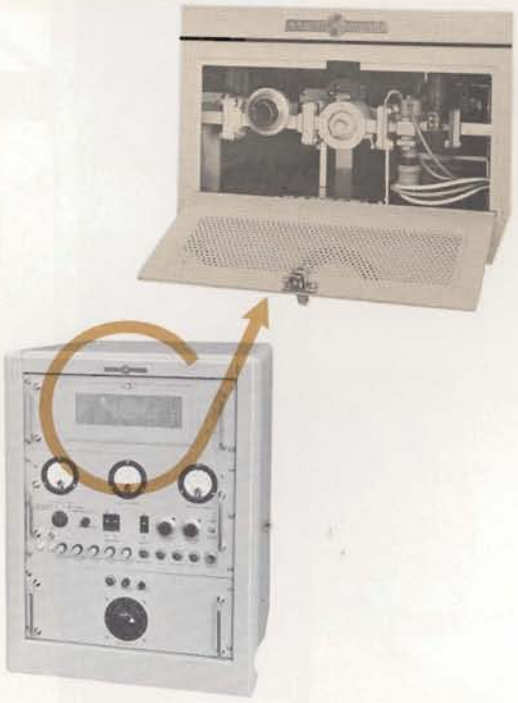
By pumping both converters from the same source of X-band power, the IF output frequency is maintained despite slight variations in pump, frequency or phase.

Lower sideband up conversion is used to provide good gain and by virtue of proper idler loading, high stability and wide instantaneous bandwidth are achieved.

The exceptionally wide bandwidth of the V-8350 provides large channel capacity when used with a wideband IF amplifier. With narrowband IF, tuning only the receiver local oscillator provides low noise operation over the entire instantaneous bandwidth of the V-8350.

Signal and receiver local oscillator inputs to the V-8350 are type N. IF output is type BNC.
Your inquiries on parametric amplifiers for other frequencies or to other specifications are invited.
Contact your local field engineering representative for additional technical data on the V-8350 or write: Radiation Division, Varian Associates, 611 Hansen Way, Palo Alto, California.

STABLE PUMPS FOR PARAMETRIC AMPLIFIERS



Special applications may require considerable amounts of stable microwave power to pump a large number of parametric amplifiers in phase.

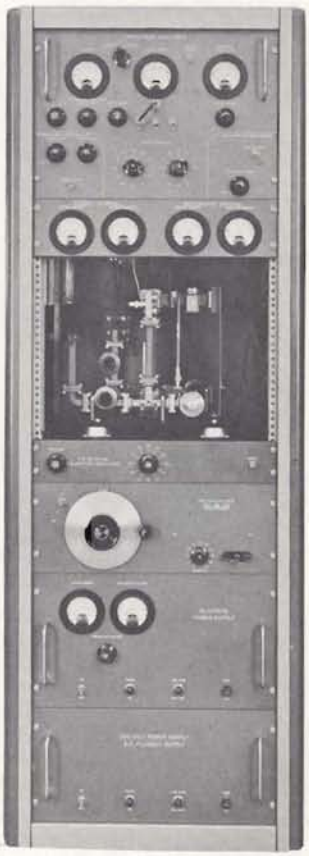
A typical unit, providing 10 watts CW at 12 kMc, is shown here. A reflex klystron, together with a passive stabilization cavity, drives a small klystron amplifier.

This combination provides the high degree of amplitude and frequency stability required for field application of parametric amplifier systems.

Custom equipment to exacting specifications can be furnished for individual applications.

PAGE 58 TO 61
PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

NOISE MEASURING TEST SET



V-7200 X-Band
V-7202 C-Band
V-7206 Ku-Band

- *Measures AM or FM Noise*
- *Ultra-High Sensitivity*
- *Direct Reading Output*
- *Built-in Calibration*

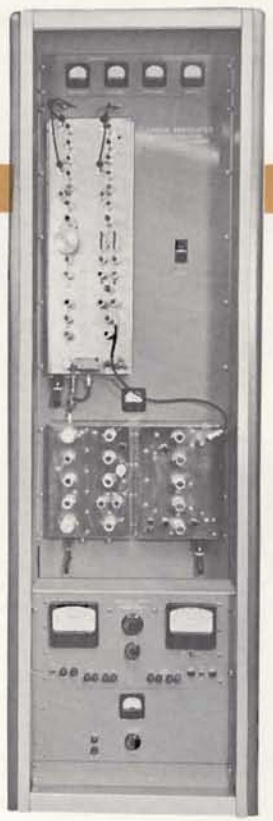
The Varian Noise Measuring Test Equipment is especially designed for accurate measurement of sideband noise output of CW microwave tubes and transmitters. The equipment is available for selected portions of C, X and Ku-band.

CHARACTERISTICS:

Noise Frequency Range	to 150 kc
Bandwidth	1.0 kc
Sensitivity	AM: 130 db. Below Carrier FM: 0.05 cps rms Equivalent Deviation

Special characteristics, such as 100 cps bandwidth, can be furnished.

PHASE DIFFERENCE DETECTOR



V-1516

- *Resolution to 0.005 Degree*
- *Accurate Measurement from 0.005° to 60°*
- *CW or Pulse Measurements*
- *Built-in Calibrator*

The V-1516 Phase Difference Detector is particularly suited for measuring phase modulation introduced in an rf signal by klystron or TWT amplifiers, or other transmission devices. Samples of the input and output signals under test are compared to determine their instantaneous relative phase from 0.005° to 60°. Phase modulation information is provided as an output voltage which can be used to operate any suitable indicator.

CHARACTERISTICS:

Frequency Range	40 Mc to 13 kMc with Separate r-f Heads
Sensitivity (CW)	0.005°:3° V/degree 3°-60°: 20 mV/degree

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EQUIPMENT

KLYSTRON POWER SUPPLY

V-7405

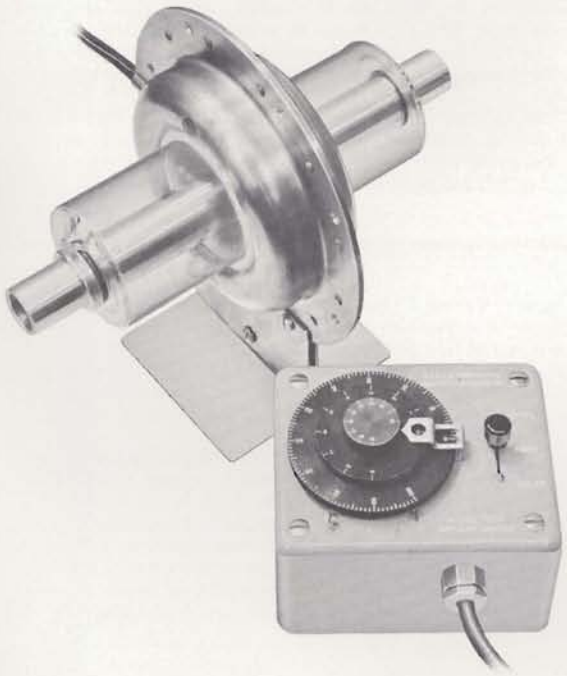
- *Extremely Low Ripple*
- *Precision Internal Modulation*
- *Wide Output Voltage Range*
- *Convenient Controls*

The V-7405 Klystron Power Supply is designed for operation of modern reflex klystron tubes in a variety of laboratory and test applications. The exceptionally low ripple of the V-7405 is essential for optimum performance of klystrons in critical laboratory and test applications including low noise and cw doppler measurements.

CHARACTERISTICS:

	Beam	Reflector	Filament
Voltage	200-850 Vdc	20-800 Vdc	6.3 Vdc
Current (max.)	100 mA	500 μA	2 A
Ripple (rms)	<100 μV	<100 μV	—
Modulation (sine wave)	—	0-200 v, 60 cps	—
Modulation (square wave or sawtooth)	—	0-200 v, 300 to 3000 cps	—

IMPULSE BRIDGE *For Measuring Pulse Voltage, Current and Impedance*



V-7204

- *High Accuracy*
- *Convenient, Reliable*
- *Impedance Measurement Independent of Oscilloscope Calibration*

The V-7204 Impulse Bridge is a combination current transformer and capacitance voltage divider connected in a bridge circuit. It provides an accurate and convenient method for measuring high-level pulse voltages and currents. In addition, the resistance component of the load can be read directly from calibrated dials. Direct calibration prevents erroneous measurements due to capacity charging currents. A three-position selector switch is provided on the control unit for measurements of pulse voltage, current or load impedance. Any calibrated oscilloscope can be used as the indicator.

CHARACTERISTICS:

Pulse Voltage		200 KV max, in oil 50 KV max, in air
Pulse Current		200 a. typical 40 A rms max.
Load Impedance		0-10,000 ohms
Output to Indicator	Voltage:	1.0 volt for 25 KV
	Current:	1.0 volt for 2.5 a
	Impedance:	Independent of indicator calibration

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PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

Using the time proved potentiometer measuring circuit and automatic null-balance principle, Varian Recorders provide versatility and compact size at moderate cost. They may be used to measure and record any phenomena which is transducible to a dc voltage or current.

Applications include the measurement and recording of temperature, pH, redox, pressure, flow, humidity, vacuum, wind velocity, light intensity, noise level, strain, power, speed, and other data.

The light weight of Varian Recorders makes them easy to move to different assignments. Their compact construction demands a minimum of panel space in equipment racks.

Features such as adjustable span, full-scale zero adjust, interchangeable measuring circuits (G-11A and G-22), and a wide range of chart speeds make the Varian Recorders capable of taking on a succession of assignments.

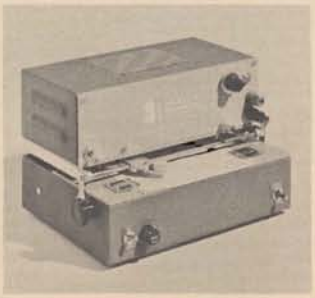
The limit of error of Varian Recorders is 1%. For the great number of laboratory uses where a more precise and more expensive Recorder is not necessary, the moderately priced Varian Recorders are the answer.

A large variety of charts such as zero-center, logarithmic, and temperature charts are available from stock. For information on charts and other supplies, write for the Varian Recorder Supply Catalog.

Special Recorders with features and configurations other than standard will be quoted on request.

For complete technical and price information on Varian Recorders, contact either the representative in your area or the Varian Instrument Division.

G-10



The Varian G-10 provides a horizontal chart feed over a convenient writing platen for those desiring to make chart notations while recording. The G-10 is the least expensive Varian Recorder, is very popular in the laboratory, and comes in two basic models:

(A) The Fixed-Span G-10 with a fixed span of 100 mv. Base price $385.00

(B) The Adjustable-Span G-10 providing continuous field adjustment of span between 10 and 100 mv with inside controls. Base price $440.00

G-11A

The Varian G-11A is available with five interchangeable input chassis providing different measuring circuits for different applications. The A1 and A2 Input Chassis provide a span adjustable from 9 to 100 mv dc. With the B1 Chassis, spans from 10 mv to 100v are available. The F1 Chassis is a current type with a 1-ma dc span. The T2 Chassis has reference-junction compensation for use with thermocouples and many standard temperature ranges are available.

One, two or four chart speeds may be provided. One-second balancing time is standard. The G-11A may be used as a portable or panel mounting unit, and the chart can be rolled up on the takeup reel or left to fall free as desired. Base price $490.00.

G-22

The newest Varian Recorder, the two channel G-22, provides two completely independent recording channels for time correlation of two variables. Both pens traverse the full five inches of calibrated chart or can be made to share the chart in any desired ratio. Rugged modular construction is used throughout. Two large volume ink reservoirs supply different colors of ink to the capillary pens which overlap by 1/16 inch.

Measuring circuits are contained in true plug-in input chassis. The A-21 and A-22 Input Chassis provide spans continuously adjustable between 10 and 100 mv. The B-22 Input Chassis has fixed span steps from 10 mv to 100 v plus an interpolating potentiometer between ranges and utilizes continuous electronic reference.

Options include alarm contact, and event markers. A temperature input chassis for use with thermocouples is under development. Base price of the standard G-22 with two A-21 Input Chassis is $1075.00.

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CHART RECORDERS

SPECIFICATIONS G-10

MODEL	FIXED-SPAN G-10 (span permanently set)	ADJUSTABLE-SPAN G-10 (continuous adjustment with inside controls)
Span (millivolts across chart)	100 mv., d.c., fixed	As specified within 10-100 mv. d.c. range
Full-scale Balancing Time—Standard Optional	2½ seconds 1 second	2½ seconds 1 second
Limit of Error	1% of span	1% of span
Sensitivity (½ deadband)	¼% of span	¼% of span
Reference System	Mercury cell	Mercury cell
Input & Source Resistance	See note below*	See note below*
Input Circuit	Ungrounded. Signals floating above ground by as much as 200 volts d.c. are permissible with proper considerations.	
Input Polarity—Standard Optional	Positive-going signals cause left-to-right pen travel. **Reversed polarity. Positive-going signals cause right-to-left pen travel.**	
Chart Dimensions	Calibrated width nominally 5"; Overall 6⅜"; Length 85'.	
Chart Speeds	1 or 2 speeds from 1"/hr to 16"/min. Select from data sheet.	
Power Requirements	110-120 volts, 1 phase, 58-62 cps, 55 volt amperes max, power factor approximately 0.7. 50-cycle version available, takes either 115 or 230 volts.	
Overall Dimensions	7" high x 10¾" wide x 10" deep.	
Weight	Basic recorder 15 lbs. net. Maximum shipping weight 25 lbs.	
Accessories Available	Inkless charts, styli, card-type charts, chart take-up unit, carrying case, replaceable chart drive motor assemblies.	

SPECIFICATIONS G-11A

MODEL	G-11A with A1 or A2 input chassis	G-11A with B1 input chassis	G-11A with F1 input chassis	G-11A with T2 input chassis
Type	Gen. purpose null-balance potentiometer	Gen. purpose potentiometer with input attenuator	Current-type for use as general purpose recording milliammeter	Thermocouple potentiometer with reference junction compensation.
Span	9-100 mv. d.c. as specified	Nine-step adjustable 10 mv. to 100 volts d.c.	1 milliampere, d.c.	Ten temp. ranges from −200°C to +1500°C
Field Span-Adjust	Continuous, with inside controls	Knob on front panel	Fixed No adjustment	Front-panel plug-in range elements
Full-scale Balancing Time	1 second	1 second	1 second	1 second
Limit of Error	1% of span	1% of span on 10 mv. 2% on all others	1% of span	1% of span
Reference System	A1—Mercury cell A2—Cont. electronic	Mercury cell	Mercury cell	Continuous electronic
Sensitivity (½ deadband)	¼% of span	¼% of span	¼% of span	¼% of span
Input Resistance	See note below*	100K ohms minimum	1350 ohms	—
Maximum Source Resistance	See note below*	—	—	—
Input Circuit	Ungrounded. Signals floating above ground by as much as 200 volts d.c. are permissible with proper considerations.			
Chart Dimensions	Calibrated width nominally 5"; Overall width 6⅜"; Length 85'.			
Chart Speeds	1, 2 or 4 speeds from ⅛"/hr to 60"/min. Select from data sheet.			
Portable Case Dimensions	10½" high x 8¼" wide x 7¾" deep.			
Panel-Mounting Case Dimensions	10⅜" high x 8⅝" wide. Depth behind front of panel 5¼". Overall depth 7¾".			
Power Requirement	110-120 volts, 1 phase, 58-62 cps, 55 volt amperes max., power factor approximately 0.7. 50-cycle version available. 110-120 volts only.			
Weight	Basic recorder 15 lbs. net. Maximum shipping weight 25 lbs.			
Accessories Available	Inkless charts, styli, solenoid-operated event marker pen, extra input chassis, replaceable chart drive motor assemblies.			

SPECIFICATIONS G-22

MODEL	G-22 with A-21 or A-22 Input Chassis	G-22 with B-22 Input Chassis
Span	10-100 mv., d.c., as specified	Nine-step adjustable from 10 mv., to 100v d.c., plus interpolating potentiometer
Span Adjust	Continuous with external controls	Continuous with external controls
Full-Scale Balancing Time	1 second	1 second
Limit of Error	1% of span	1% of span on 10 mv. 2% of span on all others
Reference System	A-21—Mercury cell A-22—Continuous electronic	Continuous electronic
Sensitivity (½ deadband)	¼% of span	¼% of span
Input Resistance	See note at right*	100K ohms minimum
Maximum Source Resistance	See note at right*	—
Input Circuits	Ungrounded, but not balanced. Each channel is electrically independent and each input signal may be floated above ground by as much as 200 volts.	
Chart Dimensions	Calibrated width nominally 5", overall width 6⅜", length 85'.	
Chart Speeds	Two or four speeds from ⅛"/hr. to 16"/min. Select from data sheet.	
Case Dimensions	11-3/16" high x 12¾" deep x 8-15/16" wide (front cover hinges extend an additional 7/16" on left front side).	
Panel Cutout Dimensions	8-13/16" wide x 11-1/16" high, 11/16" radius at each corner.	
Power	115/230 volt 58-62 cps. 65 watts.	
Weight	Basic recorder 33 pounds net. Maximum shipping weight 47 pounds.	
Accessories Available	Pens for side-by-side recording, retransmitting slidewires, event markers, alarm contacts, dual mounting case.	

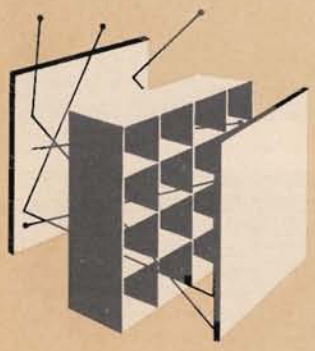
SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

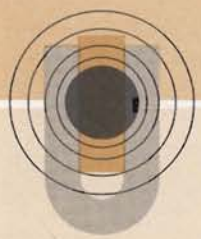
*** INPUT & SOURCE RESISTANCE (G-10, G-11A & G-22)**

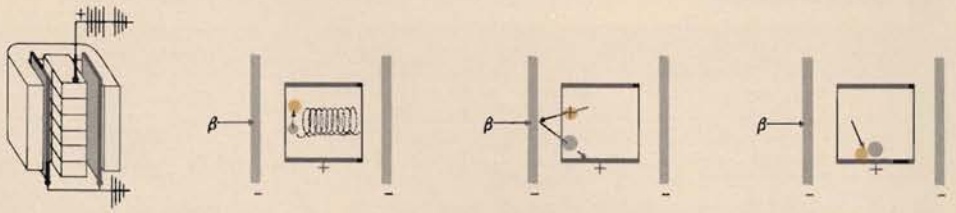
With null balance operation, the separately powered servo system adjusts the measuring voltage until it "bucks out" the measured voltage. Thus the input resistance approaches infinity at balance, is several hundred thousand ohms off balance. The result is that source resistances as high as 50K ohms are permissible with spans in the range of 10-20 mv. Permissible values increase to 75K ohms for 20-50 mv spans and to 100K ohms with spans of 50-100 mv.

For More Complete Data or Information Contact Your Local Varian Representative . . . See Pages 68 & 69

PAGE 62 TO 63
PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73







VacIon® HIGH VACUUM PUMPS

The VacIon pump is an electronic high vacuum pump capable of attaining pressures as low as 10^{-10} mm Hg. It uses a cold cathode gaseous discharge in a magnetic field to sputter titanium from a titanium cathode plate. Pumping is achieved by chemical combination with the sputtered titanium and by ion burial in the titanium. Self-regulation of the titanium consumption and long life are achieved because the sputtering rate is a linear function of pressure. A complete high vacuum system consists of a VacIon pump, permanent magnet, and a VacIon Pump Control Unit which supplies properly regulated d-c power to the pump and measures pressure by monitoring the pump current.

VacIon pumps provide a method for obtaining very low pressures in routine fashion. They give a really clean vacuum since they contain no oil or other pumping fluids. They are simple and economical to maintain and operate. They have no heated filaments or moving parts. They require no traps or baffles, cooling water, or liquid nitrogen. They do not require continuous forepumping. Once a rough vacuum has been established and the VacIon pump started, the forepump is valved off and switched off. They will operate in any position and withstand shock, vibration, temperature, and radiation.

VacIon pumps have already received widespread acceptance for vacuum tube processing, semi-conductor processing, particle accelerators, spectrometers, environmental testing, and any other application where pressures below 10^{-4} mm Hg are desirable.

VacSorb* ROUGHING PUMPS

A VacSorb pump may be used as a roughing pump for a VacIon pump since continuous forepumping is not required. Basically it is a container which is filled with a high surface area sorption material such as activated charcoal or molecular sieve. When it is chilled by immersion in liquid nitrogen, it removes gas from the vacuum system by adsorption on the surfaces of the sorption material. It will remove enough gas to lower the system pressure to the point where a VacIon pump will start. When the VacIon pump has started, the VacSorb pump is valved off and allowed to warm up to room temperature. It then releases the adsorbed gas and is ready to be used again. The VacSorb pump eliminates the noise and vibration of mechanical pumping and permits completely oil-free pumping from atmospheric pressure to 10^{-10} mm Hg.

* Trade Mark.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

VACUUM PRODUCTS

VACION® HIGH VACUUM PUMPS

A Varian invention, the VACION pump offers a new approach to obtaining clean, high vacuums. These rugged, bakeable pumps contain no liquids and hence allow vacuums to be produced without danger of contamination. Pressures below 10^{-9} mm Hg without the use of liquid nitrogen are attainable with VACION pumps. These pumps function as an accurate pressure gauge as well as a reliable pump since the current drawn by the pump is proportional to the pressure in the pump. On systems where VACION pumps are used, a forepump is only required to evacuate the system down to about 10 microns. Its use is not required after the VACION pump is started until the next pumpdown cycle.

VACION pumps are now available in 15 sizes with capacities from 0.2 to 10,000 liters/sec. Data sheets and additional technical information will be mailed to you on request.

1,000 LITER/SEC.

75 LITER/SEC.

8 LITER/SEC.

CAPACITIES FROM 0.2 TO 10,000 LITER/SEC.

VACUUM COMPONENTS

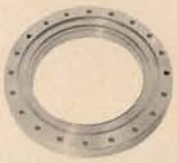
A wide variety of superior components for high vacuum systems are available. Illustrated are the following:

Varian one-inch high vacuum valve, utilizing a stainless steel bellows, can be reliably used in systems down to the 10^{-9} mm Hg pressure region.

Varian standard copper gasket sealed flanges are available in any size up to 6″ I.D. They maintain perfect seals even after repeated baking to above 500°C.

Pyrex Viewing Ports, utilizing a Housekeeper seal, permit visual access to systems without the use of elastomer O-rings.

A wide assortment of electrical feed-throughs for running high current, high voltage, or multiple instrument leads into vacuum systems are available individually or mounted on standard copper gasket-sealed flanges.



FLANGES

ONE-INCH VALVE

FEED-THROUGHS

VIEWING PORTS

COMPLETE VACUUM SYSTEMS

Many standard complete vacuum systems using Varian components are now being manufactured. Various sizes and types of bell jar vacuum units are available for thin film evaporating, high altitude simulation. vacuum brazing, vacuum firing and similar applications. Other standard units include tube processing stations. In addition, Varian invites customer's inquiries for custom vacuum systems which are designed to meet specific requirements.

STANDARD SYSTEMS

CUSTOM SYSTEMS

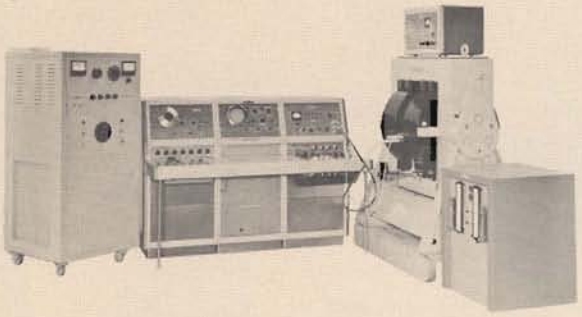
The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

PAGE 64 TO 67
PAGE 68 TO 69
PAGE 70 TO 73

Varian Associates' Instrument Division manufactures precision laboratory instruments for science and industry. Among Instrument Division products are . . .

SCIENTIFIC INSTRUMENTS

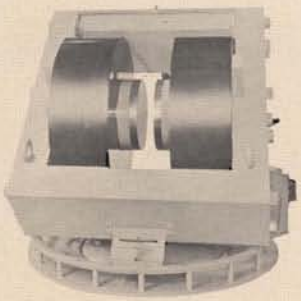
NMR* AND EPR† SPECTROMETERS



These instruments are used for non-destructive analysis of compounds in laboratories throughout the free world. The *HR-60 High Resolution 60 Megacycle NMR Spectrometer* is used for identifying the structures of compounds, and provides a resolution greater than 1 part in 100 million. The *V-4200B Wide Line NMR Spectrometer* is applicable to a wide range of fundamental studies such as isotope identification, chemical shift studies, etc. The *V-4501 EPR Spectrometer* is used in analysis of substances having a resultant electronic magnetic moment. Typical applications are identification of free radicals, color centers, triplet electronic states, transition ions, etc. The *DP-60 Dual Purpose Spectrometer*, illustrated, offers the functions of both NMR units, above and may be used in EPR work by adding certain EPR components. Varian spectrometers are supplied with matching laboratory electromagnet systems.

* Nuclear Magnetic Resonance. † Electron Paramagnetic Resonance.

LABORATORY ELECTROMAGNET SYSTEMS



V-4012-3B MAGNET

FLUXMETER

Varian laboratory electromagnet systems range from small units which create reasonably uniform magnetic fields, to large units of unparalleled field homogeneity and stability. The V-4012-3B, a 12-inch precision rotating laboratory magnet useful in applications requiring large volumes of homogeneous fields or fields of high magnetic intensity, is illustrated. All Varian magnets are water cooled, and feature a broad selection of air-gap configurations. They are furnished with matching power supplies and accessory equipment.

Fluxmeters

The *F-8 Nuclear Magnetic Resonance Fluxmeter and Control Unit* provides precise measurement and control of magnetic fields in laboratory and industrial magnet applications. Transmitter frequency is generated independently of the probe for maximum instrument stability. Long cables permit use with remotely placed magnets.

MAGNETOMETERS

The Varian Proton Free Precession Magnetometer, conceived by the late Dr. Russell Varian, provides an accurate measure of the intensity of the earth's magnetic field. The *M-49A Portable Magnetometer*, illustrated, is a lightweight, compact and rugged, transistorized field instrument for use in mineral and petroleum exploration. The *V-4914 Airborne Magnetometer* provides greater accuracy required in large scale aerial magnetic surveying. The *V-4931 Modular Station Magnetometer* is designed for adaptability for use as an observatory monitor and standard and for oceanographic exploration in a shipboard installation.

A Rubidium Vapor Optically Monitored Magnetometer has been developed which extends the sensitivity and rate of data collection of magnetic field measurements. The *V-4934 Research Rubidium Vapor Station Magnetometer* is the first available instrument using this concept.

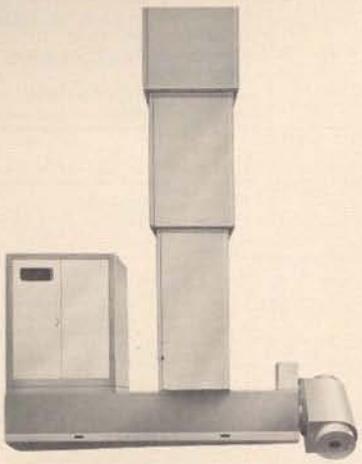
Both principles of operation have been successfully used in instruments miniaturized for rocket and satellite installations.

For Complete Information on These Products, Please Communicate Directly with Varian Associates, Instrument Division, Palo Alto, California

ELECTRON LINEAR ACCELERATORS

Varian designs and manufactures electron linear accelerators or "linacs," for use in industrial radiography, medical therapy, processing and physics and chemistry research. Several of these units are under construction at all times, and arrangements for detailed inspection visits can be made readily. We are pleased to quote on custom requirements, as well as standard radiographic and medical therapy units.

INDUSTRIAL RADIOGRAPHY



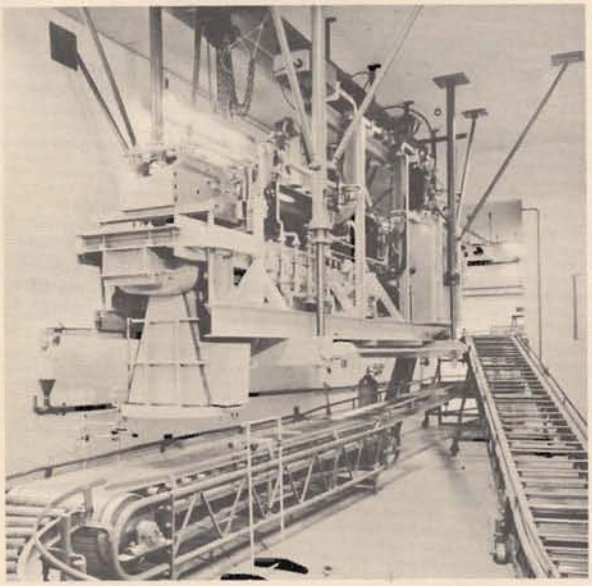
INDUSTRIAL RADIOGRAPHIC LINAC

Varian produces radiographic linacs varying in energy from 10 to 25 Mev, and in intensity from 500 to 25,000 Roentgens per minute at one meter. Focal spot sizes range from 1 to 2 mm. A feature is a unique X-ray head which projects the beam at right angles to the accelerating waveguide and rotates a full 360° in the vertical plane. Combined with the 360° rotation in the horizontal plane provided by either the Varian telescoping hoist or lift truck mounts, this feature provides a flexibility which allows a reduction of exposure room dimensions and costs.

MEDICAL THERAPY

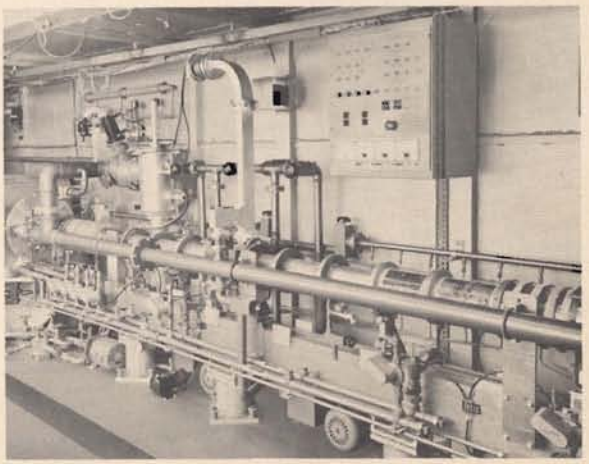
The model V-7705 medical machine produces 200 Roentgens per minute flat field at 1 meter from a 5 mm focal spot. The advanced design of this unit provides rapid accurate patient setup and allows a wide range of treatment techniques including arc, spin and rotational therapy.

FOOD PRESERVATION



The V-7700, a 10 Mev, 5 KW machine shown above was installed by Varian in a European laboratory where it is being used for food irradiation research. A 24 Mev, 18 KW linac for a food irradiation program in this country will be completed this year.

RESEARCH



The 22 Mev, 2.5 KW unit above was custom-built for a unique photonuclear research application. We are presently custom building larger research linacs which range in energy from 8 to 60 Mev and 4 to 15 KW. Preliminary designs have been made for energies as high as 300 Mev and power levels to 150 KW.

The Above Products Are Manufactured by Varian Associates . . . . . Palo Alto, California

PAGE 68 TO 69

PAGE 70 TO 73

WORLD WIDE SALES

In the Continental United States and Hawaii, Varian Associates is represented by many outstanding organizations thoroughly familiar with the fields they serve and fully qualified to handle both contractual and technical matters for customers and users of Varian products.

In countries outside the United States, Varian is represented by organizations with offices or affiliates in major cities throughout the world. In Europe, Africa, Near East, India and Pakistan, Varian products are handled by our recently established Swiss subsidiary, Varian A.G., Zug, Switzerland. Inquiries in this particular geographical area should be directed either to Varian A.G. (Switzerland) or to a Varian A.G. distributor. Names and addresses of distributors in these countries are attached.

All sales, technical representatives and distributors maintain a staff of field engineers in all major U.S. and foreign business centers. They are as near as your telephone, and will be glad to provide you with complete information on all Varian products.

COUNTRY	GRAPHIC RECORDERS	HIGH VACUUM PRODUCTS
UNITED STATES	See Territorial List of Representatives at Far Right	See Territorial List of Representatives at Far Right
ARGENTINA	Coasin S.R.L., Viel 969, Buenos Aires	
AUSTRALIA	**H. B. Selby & Co. Pty. Ltd.** • 393 Swanston St. (Box 409G GPO) Melbourne C.1 • 356 King William St. (Box 603E GPO), Adelaide, S.A. • 350 Upper Roma St. (Box 606J GPO) Brisbane, Queensland • 43 King St. (Box C100 GPO) Perth, W.A. • 35 York St. (Box 175 GPO) Sydney, N.S.W.	**H. B. Selby & Co. Pty. Ltd.** • 393 Swanston St. (Box 409G GPO) Melbourne C.1 • 356 King William St. (Box 603E GPO), Adelaide, S.A. • 350 Upper Roma St. (Box 606J GPO) Brisbane, Queensland • 43 King St. (Box C100 GPO) Perth, W.A. • 35 York St. (Box 175 GPO) Sydney, N.S.W.
BRAZIL	**Commercial Cachel Limitada** Caixa Postal 1207, Porto Alegre, RGS, Brazil	
CANADA	**ROR Associates, Ltd.*** • Don Mills, Ontario; 1470 Don Mills Rd. • Montreal, P.Q.; 3333 Cavendish Blvd., N.D.G.	**ROR Associates, Ltd.*** • Don Mills, Ontario; 1470 Don Mills Rd. • Montreal, P.Q.; 3333 Cavendish Blvd., N.D.G.
JAPAN	**Marubun Company, Ltd.** • No. 1, 2-chome, Odenmacho Nihonbashi, Chuo-ku, Tokyo • No. 14, 1-chome, Utsubo-Shimodori Nishi-ku, Osaka	**Marubun Company, Ltd.** • No. 1, 2-chome, Odenmacho Nihonbashi, Chuo-ku, Tokyo • No. 14, 1-chome, Utsubo-Shimodori Nishi-ku, Osaka
MEXICO	**Hoffman-Pinther & Bosworth S.A.** Apartado Postal 101-Bis, Mexico 1, D.F.	
NEW ZEALAND	**Watson Victor Ltd.** 16 The Terrace, Wellington C.1	
EUROPE • AFRICA • NEAR EAST • INDIA • PAKISTAN	Varian, A.G. • Gubelstrasse 7 Zug, Switzerland	Varian, A.G. • Gubelstrasse 7 Zug, Switzerland

COUNTRY	MAGNETS & SPECTROMETERS	PORTABLE MAGNETOMETERS
UNITED STATES	Varian Associates, Instrument Division Palo Alto, California	Varian Associates, Instrument Division Palo Alto, California
AUSTRALIA	**H. B. Selby & Co. Pty. Ltd.** • 393 Swanston St. (Box 409G GPO) Melbourne C.1 • 356 King William St. (Box 603E GPO), Adelaide, S.A. • 350 Upper Roma St. (Box 606J GPO) Brisbane, Queensland • 43 King St. (Box C100 GPO) Perth, W.A. • 35 York St. (Box 175 GPO) Sydney, N.S.W.	
CANADA	Varian Associates, Instrument Division Palo Alto, California	
JAPAN	**Marubun Company, Ltd.** • No. 1, 2-chome, Odenmacho Nihonbashi, Chuo-ku, Tokyo • No. 14, 1-chome, Utsubo-Shimodori Nishi-ku, Osaka	**Marubun Company, Ltd.** • No. 1, 2-chome, Odenmacho Nihonbashi, Chuo-ku, Tokyo • No. 14, 1-chome, Utsubo-Shimodori Nishi-ku, Osaka
MEXICO	**Hoffman-Pinther & Bosworth S.A.** Apartado Postal 101-Bis, Mexico 1, D.F.	
EUROPE • AFRICA • NEAR EAST • INDIA • PAKISTAN	Varian, A.G. • Gubelstrasse 7 Zug, Switzerland	Varian, A.G. • Gubelstrasse 7 Zug, Switzerland

* *Sales Representatives for Varian Associates of Canada, Ltd.*

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MICROWAVE TUBES

See Territorial List of Representatives at Far Right

Jacoby, Mitchell & Co.
- 469-475 Kent Street
  Sydney, N.S.W., Australia
- 113 Bridge Rd.
  Richmond E1, Victoria, Australia

H. P. Chambers
- 135 Beaumont St., Hamilton, N.S.W

ROR Associates, Ltd.*
- Don Mills, Ontario; 1470 Don Mills Rd.
- Montreal, P.Q.; 3333 Cavendish Blvd., N.D.G.

Marubun Company, Ltd.
- No. 1, 2-chome, Odenmacho
  Nihonbashi, Chuo-ku, Tokyo
- No. 14, 1-chome, Utsubo-Shimodori
  Nishi-ku, Osaka

Varian, A. G.
- Gubelstrasse 7
  Zug, Switzerland

HOME OFFICE

VARIAN associates

PALO ALTO, CALIFORNIA

WASHINGTON, D.C., OFFICE
- 1725 K Street, N.W.
  Washington 6, D.C.
  Phone FE 3-8833

UNITED STATES REPRESENTATIVES FOR BOMAC PRODUCTS

NEW ENGLAND STATES & EASTERN NEW YORK
YEWELL ASSOCIATES, INC.
- Burlington, Mass., Middlesex Turnpike, BR 2-9000
- Bridgeport, Conn., 1101 E. Main Street, FO 6-3456
- Poughkeepsie, New York, 806 Main St., GR 1-3456

NORTHERN & WESTERN NEW YORK
J. D. RYERSON ASSOCIATES, INC.
- Syracuse 1, New York, P.O. Box 1400, GI 6-1771

NEW YORK CITY & NORTHERN NEW JERSEY
BERTRAM D. AARON
- Roslyn, Long Island, N.Y., P.O. Box 186, MA 1-0630
- Roslyn Harbor, Long Island, N.Y., MA 1-0664

EASTERN PENNSYLVANIA & SOUTHERN NEW JERSEY
I. E. ROBINSON COMPANY
- West Conshohocken, Pa., 144 Elizabeth St., TA 8-6200
- Camp Hill, Pa., Park Place Office Bldg., P.O. Box 187, RE 7-6791
- Asbury Park, N.J., 905 Main St., KE 1-3150

DELAWARE, MARYLAND & WASHINGTON, D.C.
HORMAN ASSOCIATES, INC.
- Rockville, Md., 941 Rollins Avenue, HA 7-7560
- Baltimore, Md., 3006 W. Cold Spring Lane, MO 4-4400

SOUTHEASTERN STATES
BIVINS & CALDWELL, INC.
- High Point, North Carolina, 1923 No. Main St., 2-6873
- Atlanta 5, Ga., 3110 Maple Dr., N.E., CE 3-7522
- Richmond 30, Va., P.O. Box 6514, EL 5-7931
- Huntsville, Ala., 534-5733 (Direct to Atlanta).

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STILES ASSOCIATES, INC.
- Orlando, Florida, 1226 East Colonial Drive, GA 5-5541
- St. Petersburg 8, Fla., Madeira Beach, WA 1-0211

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- Cleveland 24, Ohio, 5827 Mayfield Rd., HI 2-8080
- Pittsburgh 27, Pa., G.B.U. Bldg., 4232 Brownsville Road, TU 4-5515

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CROSSLEY ASSOCIATES, INC.
- Chicago 45, Illinois, 2501 W. Peterson Ave., BR 5-1600
- Dayton 19, Ohio, 2801 Far Hills Avenue, AX 9-3594
- St. Paul 14, Minn., 842 Raymond Ave., MI 6-7881
- Indianapolis 20, Ind., 5420 N. College Ave., CL 1-9255

NORTHWESTERN STATES
DON SMITH SALES CO.
- Seattle, Washington, 2320 North 45th St., ME 3-3160

WEST CENTRAL STATES
LAHANA AND COMPANY
- Denver 10, Colorado, 1886 South Broadway, PE 3-3791
- Salt Lake City, Utah, 1482 Major St., HU 6-8166

KANSAS, MISSOURI & SOUTHERN ILLINOIS
HARRIS-HANSON COMPANY
- St. Louis 17, Mo., 2814 So. Brentwood Blvd., MI 7-4350
- Kansas City 32, Mo., 7916 Paseo Street, HI 4-9494

SOUTH CENTRAL STATES
McKINNEY SALES CO.
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- Houston 36, Texas, P.O. Box 3126, MO 5-3653
- Tulsa 35, Oklahoma, 8512 East 32nd St., TE 5-4730
- Kenner, Louisiana, 1102 Fairway

CALIFORNIA & SOUTHWESTERN STATES
NEELY ENTERPRISES
- N. Hollywood, Calif., 3939 Lankershim Blvd., TR 7-0721
- Sacramento 14, Calif., 1317-15th Street, GI 2-8901
- San Diego 6, Calif., 1055 Shafter St., AC 3-8106
- San Carlos, Calif., 501 Laurel Street, LY 1-2626
- Albuquerque, N.M., P.O. Box 8366, Sta. C, AL 5-5586
- Las Cruces, N.M., 114 So. Water St., JA 6-2486
- Phoenix, Arizona, 641 E. Missouri Avenue, CR 4-5431
- Tucson, Arizona, 232 So. Tucson Blvd., MA 3-2564

UNITED STATES REPRESENTATIVES FOR VARIAN MICROWAVE TUBES & COMPONENTS RECORDERS & HIGH VACUUM PRODUCTS

NEW ENGLAND STATES & EASTERN NEW YORK
YEWELL ASSOCIATES, INC.
- Burlington, Mass., Middlesex Turnpike, BR 2-9000
- Bridgeport, Conn., 1101 E. Main Street, FO 6-3456
- Poughkeepsie, New York, 806 Main St., GR 1-3456

NORTHERN & WESTERN NEW YORK
J. D. RYERSON ASSOCIATES, INC.
- Syracuse 1, New York, P.O. Box 1400, GI 6-1771

NEW YORK CITY & NORTHERN NEW JERSEY
RMC ASSOCIATES
- New York, New York, 236 East 75th Street, TR 9-2023
- Englewood, New Jersey, 391 Grand Avenue, LO 7-3933

EASTERN PENNSYLVANIA & SOUTHERN NEW JERSEY
I. E. ROBINSON COMPANY
- West Conshohocken, Pa., 144 Elizabeth St., TA 8-6200
- Camp Hill, Pa., Park Place Office Bldg., P.O. Box 187, RE 7-6791
- Asbury Park, N.J., 905 Main St., KE 1-3150

DELAWARE, MARYLAND & WASHINGTON, D.C.
HORMAN ASSOCIATES, INC.
- Rockville, Md., 941 Rollins Avenue, HA 7-7560
- Baltimore, Md., 3006 W. Cold Spring Lane, MO 4-4400

SOUTHEASTERN STATES
BIVINS & CALDWELL, INC.
- High Point, North Carolina, 1923 No. Main St., 2-6873
- Atlanta 5, Ga., 3110 Maple Dr., N.E., CE 3-7522
- Richmond 30, Va., P.O. Box 6514, EL 5-7931
- Huntsville, Ala., 534-5733 (Direct to Atlanta).

FLORIDA
STILES ASSOCIATES, INC.
- Orlando, Florida, 1226 East Colonial Drive, GA 5-5541
- St. Petersburg 8, Fla., Madeira Beach, WA 1-0211

MICHIGAN, NORTHERN OHIO & WESTERN PA.
S. STERLING COMPANY
- Detroit 35, Mich., 15310 W. McNichols Rd., BR 3-2900
- Cleveland 24, Ohio, 5827 Mayfield Rd., HI 2-8080
- Pittsburgh 27, Pa., G.B.U. Bldg., 4232 Brownsville Road, TU 4-5515

NORTH CENTRAL STATES
CROSSLEY ASSOCIATES, INC.
- Chicago 45, Illinois, 2501 W. Peterson Ave., BR 5-1600
- Dayton 19, Ohio, 2801 Far Hills Avenue, AX 9-3594
- St. Paul 14, Minn., 842 Raymond Ave., MI 6-7881
- Indianapolis 20, Ind., 5420 N. College Ave., CL 1-9255

NORTHWESTERN STATES & ALASKA
ARVA, INC.
- Seattle 9, Washington, 1320 Prospect St., MA 2-0177
- Portland, Oregon, 1238 N.W. Glisan, CA 2-7337

WEST CENTRAL STATES
LAHANA AND COMPANY
- Denver 10, Colorado, 1886 South Broadway, PE 3-3791
- Salt Lake City, Utah, 1482 Major St., HU 6-8166

KANSAS, MISSOURI & SOUTHERN ILLINOIS
HARRIS-HANSON COMPANY
- St. Louis 17, Mo., 2814 So. Brentwood Blvd., MI 7-4350
- Kansas City 32, Mo., 7916 Paseo Street, HI 4-9494

SOUTH CENTRAL STATES
EARL LIPSCOMB ASSOCIATES
- Dallas 9, Texas, Box 7084, FL 7-1881
- Houston 6, Texas, 3825 Richmond Avenue, MO 7-2407

CALIFORNIA & SOUTHWESTERN STATES
NEELY ENTERPRISES
- N. Hollywood, Calif., 3939 Lankershim Blvd., TR 7-0721
- Sacramento 14, Calif., 1317-15th Street, GI 2-8901
- San Diego 6, Calif., 1055 Shafter St., AC 3-8106
- San Carlos, Calif., 501 Laurel Street, LY 1-2626
- Albuquerque, N.M., P.O. Box 8366, Sta. C, AL 5-5586
- Las Cruces, N.M., 114 So. Water St., JA 6-2486
- Phoenix, Arizona, 641 E. Missouri Avenue, CR 4-5431
- Tucson, Arizona, 232 So. Tucson Blvd., MA 3-2564

HAWAII
ARVA, INC.
- Honolulu 3, P.O. Box 2845, Phone 269-781

PAGE 68 TO 69

PAGE 70 TO 73

PRODUCT INDEX

KLYSTRONS

Number	Page	Product
X-12	9	Reflex Oscillator Klystron
X-13	7	Reflex Oscillator Klystron
X-13B	7	Reflex Oscillator Klystron
V-23	17	Oscillator Klystron
V-24C Series	30	Pulse Amplifier Klystron
X-26 Series	14	Reflex Oscillator Klystron
V-27	17	Amplifier Klystron
V-27B	17	Amplifier Klystron
VA-28	19	Oscillator Klystron
V-39B	9	Reflex Oscillator Klystron
V-40B	9	Reflex Oscillator Klystron
V-45	18	Multiplier Klystron
V-53B	15	Reflex Oscillator Klystron
V-54	15	Reflex Oscillator Klystron
V-55	14	Reflex Oscillator Klystron
V-55B	15	Reflex Oscillator Klystron
V-58	15	Reflex Oscillator Klystron
V-58C	15	Reflex Oscillator Klystron
V-63	17	Oscillator Klystron
VA-64F	19	Oscillator Klystron
VA-64G	19	Oscillator Klystron
VA-67B	19	Oscillator Klystron
V-82B	30	Pulse Amplifier Klystron
VA-87B,C	28	Pulse Amplifier Klystron
VA-92	10	Reflex Oscillator Klystron
VA-92B	10	Reflex Oscillator Klystron
VA-92C	10	Reflex Oscillator Klystron
VA-94	10	Reflex Oscillator Klystron
VA-94B	10	Reflex Oscillator Klystron
VA-96	11	Reflex Oscillator Klystron
VA-97	11	Reflex Oscillator Klystron
VA-97B	11	Reflex Oscillator Klystron
VA-98E	11	Reflex Oscillator Klystron
VA-113-14-15	14	Reflex Oscillator Klystron
V-153/6315	15	Reflex Oscillator Klystron
V-154	15	Reflex Oscillator Klystron
V-157	15	Reflex Oscillator Klystron
VA-201B	7	Reflex Oscillator Klystron
VA-203B/6975	7	Reflex Oscillator Klystron
VA-204	9	Reflex Oscillator Klystron
VA-210B	8	Reflex Oscillator Klystron
VA-217C	7	Reflex Oscillator Klystron
VA-218B	9	Reflex Oscillator Klystron
VA-220A-G	6	Reflex Oscillator Klystron
VA-220J	5	Reflex Oscillator Klystron
VA-220Z	6	Reflex Oscillator Klystron
VA-221A-G	6	Reflex Oscillator Klystron
VA-221H	5	Reflex Oscillator Klystron
VA-221K	6	Reflex Oscillator Klystron
VA-222A-G	6	Reflex Oscillator Klystron
VA-222Z	6	Reflex Oscillator Klystron
VA-225A,B	6	Reflex Oscillator Klystron
VA-225C	6	Reflex Oscillator Klystron
VA-232	8	Reflex Oscillator Klystron
VA-239	11	Reflex Oscillator Klystron
VA-240	10	Reflex Oscillator Klystron
VA-242 Series	8	Reflex Oscillator Klystron
VA-244A,B,C	5	Reflex Oscillator Klystron
VA-246	10	Reflex Oscillator Klystron
VA-249	8	Reflex Oscillator Klystron
VA-250	11	Reflex Oscillator Klystron
V-260/6310	15	Reflex Oscillator Klystron
V-262	15	Reflex Oscillator Klystron
V-270/6312	15	Reflex Oscillator Klystron
V-290/6314	15	Reflex Oscillator Klystron
VA-401	18	Amplifier Klystron
VA-403	18	Amplifier Klystron
VA-503B,C	19	Oscillator Klystron
VA-504B	19	Oscillator Klystron
VA-800	22	CW Amplifier Klystron
VA-800C	22	CW Amplifier Klystron
VA-802B	22	CW Amplifier Klystron
VA-804 Series	23	CW Amplifier Klystron
VA-805 Series	23	CW Amplifier Klystron
VA-806 Series	24	CW Amplifier Klystron
VA-808 Series	30	Pulse Amplifier Klystron
VA-812C	27	Pulse Amplifier Klystron

KLYSTRONS (CONTINUED)

Number	Page	Product
VA-816J	29	Pulse Amplifier Klystron
VA-820B,C	28	Pulse Amplifier Klystron
VA-822 Series	25	CW Amplifier Klystron
VA-823 Series	25	CW Amplifier Klystron
VA-824B	18	Amplifier Klystron
VA-833C	21	CW Amplifier Klystron
VA-834B	23	CW Amplifier Klystron
VA-839	29	Pulse Amplifier Klystron
VA-842	27	Pulse Amplifier Klystron
VA-845 Series	30	Pulse Amplifier Klystron
VA-846 Series	23	CW Amplifier Klystron
VA-848 Series	25	CW Amplifier Klystron
VA-849 Series	24	CW Amplifier Klystron
VA-851 Series	25	CW Amplifier Klystron
VA-853	21	CW Amplifier Klystron
VA-856 Series	24	CW Amplifier Klystron
VA-863 Series	24	CW Amplifier Klystron
VA-6915	15	Reflex Oscillator Klystron
BL-800/6780	12	Reflex Klystron
BL-800A/6316	12	Reflex Klystron
BL-803/6781	13	Reflex Klystron
BL-806	12	Reflex Klystron
BL-807	13	Reflex Klystron
BL-814	13	Reflex Klystron
BL-829	12	Reflex Klystron
BL-841	13	Reflex Klystron
BL-843	13	Reflex Klystron
6310	12	Reflex Klystron
6312	13	Reflex Klystron

FOCUSING ELECTROMAGNETS

Number	Page	Product
VA-1502	22	for VA-800C Tube
VA-1503B	28	for VA-87B,C Tube
VA-1504	23	for VA-804 Tube
VA-1505	23	for VA-805 Tube
VA-1506B	24	for VA-806 Tube
VA-1512	28	for VA-820B,C Tube
VA-1512	29	for VA-816J Tube
VA-1520	22	for VA-800 Tube
VA-1521C	21	for VA-833C Tube
VA-1523	25	for VA-823 Tube
VA-1525	39	for VA-125A and VA-125B Tube
VA-1526	39	for VA-126 Tube
VA-1532	38	for VA-132 Tube
VA-1539	29	for VA-839 Tube
VA-1542	27	for VA-842 Tube
VA-1546	23	for VA-846 Tube
VA-1549	24	for VA-849 Tube
VA-1553	21	for VA-853 Tube
VA-1556	24	for VA-856 Tube
VA-1563	24	for VA-863 Tube

TRAVELING WAVE TUBES

Number	Page	Product
VA-125A	39	Pulse Amplifier TWT
VA-125B	39	Pulse Amplifier TWT
VA-126	39	Pulse Amplifier TWT
VA-128	39	Pulse Amplifier TWT
VA-131	38	Pulse Amplifier TWT
VA-132	38	CW Amplifier TWT
VA-133	38	Pulse Amplifier TWT
VA-134	38	Pulse Amplifier TWT
VA-601	39	CW Amplifier TWT

BACKWARD WAVE OSCILLATORS

Number	Page	Product
VA-161	37	BWO
VA-161B	36	BWO
VA-162	37	BWO
VA-163	37	BWO
VA-164	37	BWO
VA-168	37	BWO
VA-169	36	BWO
VA-181	36	BWO
BL-857	31	Type "M" BWO

MAGNETRONS

Number	Page	Product
5780	34	Magnetron
6551	35	Magnetron
7088/BL-212	31	Magnetron
7446/BL-233	34	Magnetron
7503/BLM-024	33	Magnetron
BL-212/7088	31	Magnetron
BL-221	35	Magnetron
BL-223A	32	Magnetron
BL-230	33	Magnetron
BL-233/7446	34	Magnetron
BL-235	35	Magnetron
BL-236	35	Magnetron
BL-237	35	Magnetron
BL-242	32	Magnetron
BL-244	33	Magnetron
BL-245	33	Magnetron
BL-246	35	Magnetron
BL-250	32	Magnetron
BLM-003	33	Magnetron
BLM-006	35	Magnetron
BLM-008	32	Magnetron
BLM-012	34	Magnetron
BLM-014	33	Magnetron
BLM-015	34	Magnetron
BLM-020	33	Magnetron
BLM-022	32	Magnetron
BLM-024/7503	33	Magnetron
BLM-026	32	Magnetron
BLM-027	34	Magnetron
BLM-044	34	Magnetron
BLM-071	35	Magnetron

GAS SWITCHING TUBES

Number	Page	Product
1B24A	50	TR
1B26	52	TR
1B27	48	TR
1B36	52	ATR
1B38	48	Pre-TR
1B40	47	TR
1B44	48	ATR
1B50	50	TR
1B51	50	ATR
1B52	48	ATR
1B53	48	ATR
1B54	48	Pre-TR
1B55	48	TR
1B56	48	ATR
1B57	48	ATR
1B58A	48	TR
1B62	48	TR
1B63A	50	TR
1B63B	50	TR
5792	48	ATR
5793	48	ATR
5853	48	TR
5863	50	TR
5865	49	TR
5921	48	ATR
5922	48	ATR
5925	49	TR
5927	48	TR
5939A	47	Pre-TR
6022	49	ATR
6024	48	ATR
6035	50	TR
6081	49	ATR
6117	48	TR
6164	50	TR
6232	50	TR
6260	47	Pre-TR
6282/BL-11	52	TR
6304/BL-43	50	ATR
6322/BL-25	47	TR
6334/BL-27	51	Dual TR
6368	50	TR
6378/BL-62	50	TR

PRODUCT INDEX

GAS SWITCHING TUBES (CONTINUED)

Number	Page	Product
6393/BL-68	50	ATR
6396	50	ATR
6455/BL-61	49	ATR
6560/BL-35	52	Dual TR
6564/BL-71	51	Dual TR
6565/BL-313	51	TR & Shutter
6591	49	ATR
6596/BL-317	51	Dual TR & Shutter
6601/BL-327	51	Dual TR & Shutter
6602/BL-329	48	TR & Shutter
6605/BL-96A	47	Pre-TR
6615/BL-312	51	TR & Shutter
6624	49	TR
6629/BL-54	50	ATR
6630/BL-55	50	ATR
6633/BL-37A	47	TR
6634/BL-90	47	Dual TR
6636/BL-87	48	Dual TR
6639/BL-46	49	TR
6640/BL-60	49	Dual TR
6641/BL-86	49	Dual TR
6642/BL-600	51	Dual TR
6644/BL-95	50	TR
6645/BL-95H	50	TR
6646/BL-604	51	Dual TR
6647/BL-604H	51	Dual TR
6649/BL-56	52	TR
6650/BL-67	52	TR
6685/BL-616	52	Dual TR
6795	50	TR
6905/BL-613	49	Dual TR
6906/BL-643	49	TR
6962/BL-665	47	ATR
7115/BL-915	50	TR
7152/BL-612	47	Pre-TR
7166/BL-933	47	TR
721B	48	TR
724B	50	TR
7309/BL-693	47	Cell Type, TR
7324/BL-931	47	Cell Type, TR
7381	51	Dual TR
7447/BL-352A	49	Dual TR & Shutter
BL-11/6282	52	TR
BL-15	52	ATR
BL-16	52	TR
BL-25/6322	47	TR
BL-27/6334	51	Dual TR
BL-29	50	TR
BL-35/6560	52	Dual TR
BL-37A/6633	47	TR
BL-41	48	ATR
BL-43/6304	50	ATR
BL-46/6639	49	TR
BL-47	50	TR
BL-54/6629	50	ATR
BL-55/6630	50	ATR
BL-56/6649	52	TR
BL-60/6640	49	Dual TR
BL-61/6455	49	ATR
BL-62/6378	50	TR
BL-67/6650	52	TR
BL-68/6393	50	ATR
BL-71/6564	51	Dual TR
BL-86/6641	49	Dual TR
BL-87/6636	48	Dual TR
BL-90/6634	47	Dual TR
BL-95/6644	50	TR
BL-95A	50	TR
BL-95H/6645	50	TR
BL-96A/6605	47	Pre-TR
BL-312/6615	51	TR & Shutter
BL-313/6565	51	TR & Shutter
BL-317/6596	51	Dual TR & Shutter
BL-325	51	Shutter Only
BL-327/6601	51	Dual TR & Shutter
BL-329/6602	48	TR & Shutter
BL-336	49	Dual TR & Shutter

GAS SWITCHING TUBES (CONTINUED)

Number	Page	Product
BL-337	49	TR & Shutter
BL-338H	51	TR & Shutter
BL-339H	51	Dual TR & Shutter
BL-341	51	Dual TR & Shutter
BL-345	48	TR & Shutter
BL-346	48	Dual TR & Shutter
BL-350	49	TR & Shutter
BL-351	48	TR & Shutter
BL-352	49	Dual TR & Shutter
BL-352A/7447	49	Dual TR & Shutter
BL-356	51	TR & Shutter
BL-357	48	Dual TR & Shutter
BL-359	51	TR & Shutter
BL-360H	51	Dual TR & Shutter
BL-361	51	TR & Shutter
BL-362	49	Dual TR & Shutter
BL-365	51	Shutter Only
BL-366	49	TR & Shutter
BL-367	51	TR & Shutter
BL-373	49	TR & Shutter
BL-377	49	TR & Shutter
BL-600/6642	51	Dual TR
BL-604/6646	51	Dual TR
BL-604H/6647	51	Dual TR
BL-605	49	TR
BL-606	49	ATR
BL-612/7152	47	Pre-TR
BL-612A	47	Pre-TR
BL-612B	47	Pre-TR
BL-613/6905	49	Dual TR
BL-616/6685	52	Dual TR
BL-621	52	TR
BL-622	47	Cell Type, TR
BL-627	52	ATR
BL-638	48	Dual TR
BL-639	52	TR
BL-640A	47	ATR
BL-643/6906	49	TR
BL-644	49	Dual TR
BL-645	52	Dual TR
BL-651H	51	Dual TR
BL-652	48	Dual TR
BL-660	48	ATR
BL-664A	47	ATR
BL-665/6962	47	ATR
BL-665A	47	ATR
BL-670	48	Crystal Protector
BL-690	47	Cell Type, TR
BL-693/7309	47	Cell Type, TR
BL-907	52	Dual TR
BL-908	52	TR
BL-915/7115	50	TR
BL-920	47	Pre-TR
BL-924	50	TR
BL-929	47	Cell Type, TR
BL-930	47	Cell Type, TR
BL-931/7324	47	Cell Type, TR
BL-931A	47	Cell Type, TR
BL-933/7166	47	TR
BL-934	52	Dual TR
BL-934A	52	Dual TR
BL-946	48	ATR
BL-947	51	Dual TR
BL-948	50	TR
BL-954	49	Pre-TR
BL-959	47	Cell Type, TR
BL-962	51	Pre-TR
BL-963	48	ATR
BL-964	48	ATR
BL-965	50	TR
BL-966	47	TR
BL-967	52	TR
BL-969	48	TR
BL-971	49	Crystal Protector
BL-982	49	Pre-TR
BL-984	47	Cell Type, TR
BL-990	50	TR

GAS SWITCHING TUBES (CONTINUED)

Number	Page	Product
BL-991	47	Cell Type, TR
BL-993	52	TR
BL-994	47	Cell Type, TR
BL-995	47	Cell Type, TR
BL-997	49	Pre-TR
BL-998	51	Dual TR
BL-999	47	Cell Type, TR
BLS-509	47	Crystal Protector
BLT-004	47	Cell Type, TR
BLT-005	47	Cell Type, TR
BLT-014	51	Dual TR
BLT-018	47	Cell Type, TR
BLT-019	47	Cell Type, TR
BLT-020	47	Cell Type, TR
BLT-021	47	Cell Type, TR
BLT-036	52	Dual TR
BLT-037	52	TR
BLW-005	47	Pre-TR

TUBE ACCESSORIES

Number	Page	Product
BL-107	56	Pressurizing Window
BL-112	56	Pressurizing Window
BL-114	56	Pressurizing Window
BL-116	57	Pressurizing Window
BL-117	56	Pressurizing Window
BL-119	56	Pressurizing Window
BL-122	56	Pressurizing Window
BL-123	56	Pressurizing Window
BL-124	56	Pressurizing Window
BL-125	56	Pressurizing Window
BL-132	56	Pressurizing Window
BL-133	56	Pressurizing Window
BL-134	56	Pressurizing Window
BL-136	56	Pressurizing Window
BL-139	56	Pressurizing Window
BL-141	56	Pressurizing Window
BL-143	57	Pressurizing Window
BL-144	56	Pressurizing Window
BL-145	56	Pressurizing Window
BL-704	56	Pressurizing Window
BL-707	56	Pressurizing Window
BL-710	56	Pressurizing Window
BL-711	56	Pressurizing Window
BL-712	56	Pressurizing Window
BL-713	56	Pressurizing Window
BL-715	57	Pressurizing Window
BL-722	56	Pressurizing Window
BL-729	57	Pressurizing Window
BL-730	56	Pressurizing Window
BL-731	57	Pressurizing Window
BL-737	57	Pressurizing Window
BL-738	56	Pressurizing Window
BL-739	56	Pressurizing Window
BL-741	56	Pressurizing Window
BL-742	56	Pressurizing Window
BL-743	56	Pressurizing Window
BL-746	56	Pressurizing Window
BL-747	56	Pressurizing Window
BL-754	57	Pressurizing Window
BL-755	56	Pressurizing Window
BL-760	57	Pressurizing Window
BL-764	56	Pressurizing Window
BL-769	56	Pressurizing Window
BL-774	56	Pressurizing Window
BL-777	56	Pressurizing Window
BL-780	56	Pressurizing Window
BL-788	56	Pressurizing Window
BL-789	56	Pressurizing Window
BL-794	56	Pressurizing Window
BLW-026	56	Pressurizing Window
VA-1011A	57	Connector
VA-1011B	57	Connector
VA-1120	57	Adapter
VA-1121	57	Adapter
VA-1122	57	Adapter
VA-1123	57	Adapter

PAGE 70 TO 73

PRODUCT INDEX

*Trade-mark

PRODUCT INDEX

*Trademark

GENERAL SALES INFORMATION*

ORDERING

It is to your advantage to place orders through your Varian or Bomac representative, when appropriate, for the product or products concerned . . . by so doing, you can take advantage of a complete local order service. If this is not possible, all orders should be addressed to the proper product division. Such orders should be made out to Varian Associates or Bomac Laboratories, (division), c/o your Varian or Bomac Representative. In all cases the Varian or Bomac type or model number must be specified. Inquiries and orders for export should be sent directly to the foreign representative or distributor in your country handling the product.

SPECIFICATIONS

Standard products manufactured by Varian and Bomac are fully specified and copies of these specifications are available on request. Proper application of products should not depend upon characteristics which are not covered by specifications. Varian and Bomac guarantee only those characteristics which are covered by their specifications.

If additional, or changes in, specification items are required for your application, please contact the factory. Lengthy delays will usually result if specifications and/or drawings are referenced on your order which have not been previously approved by Varian Associates or Bomac Laboratories.

SHIPPING

On many products premium transportation is strongly recommended by the factory. Shipment by other methods will be made at the customer's risk.

DELIVERY

Delivery schedules vary depending on the product and quantity ordered. Prompt shipment from stock on orders for small quantities of most standard items is general practice. We recommend that you contact your appropriate Varian or Bomac Sales Representative or the factory for delivery information at the time you place an order. Orders for large quantities may require from 90 to 120 days manufacturing lead time.

RETURNS

Since many returned products are found to be within specifications, please make sure that the product is at fault before returning. Delays in handling can be avoided if complete information, preferably a complete Service Report Form, is enclosed with the item returned, and shipment is made to the proper product division. Careful packing, preferably in the original container, and the use of premium transportation when required, will also help to avoid delays.

PRICES

All prices are net and are not subject to trade or other discounts. Quantity prices are offered under certain conditions on many standard items. Additional information may be obtained from your appropriate Varian or Bomac Sales Representative or from the Varian or Bomac product division.

Prices are subject to change without notice.

TERMS

Terms of payment are net 30 days.

WARRANTIES

All Varian and Bomac products are thoroughly tested and inspected prior to shipment and are warranted to perform satisfactorily. Warranty periods vary with the product. Should any product prove unsatisfactory, please refer to *Returns* above.

APPLICATION ENGINEERING

Engineers specially qualified in the application of Varian and Bomac products are at your disposal. This service is offered not only to the equipment designer but also to the manufacturer during production as well as to the end user of Varian products.

** Specific sales information on products such as Spectrometer Systems, Magnet Systems, Fluxmeters and Magnetometers may vary from the above general statements. In this case, please contact Varian Instrument Division.*

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